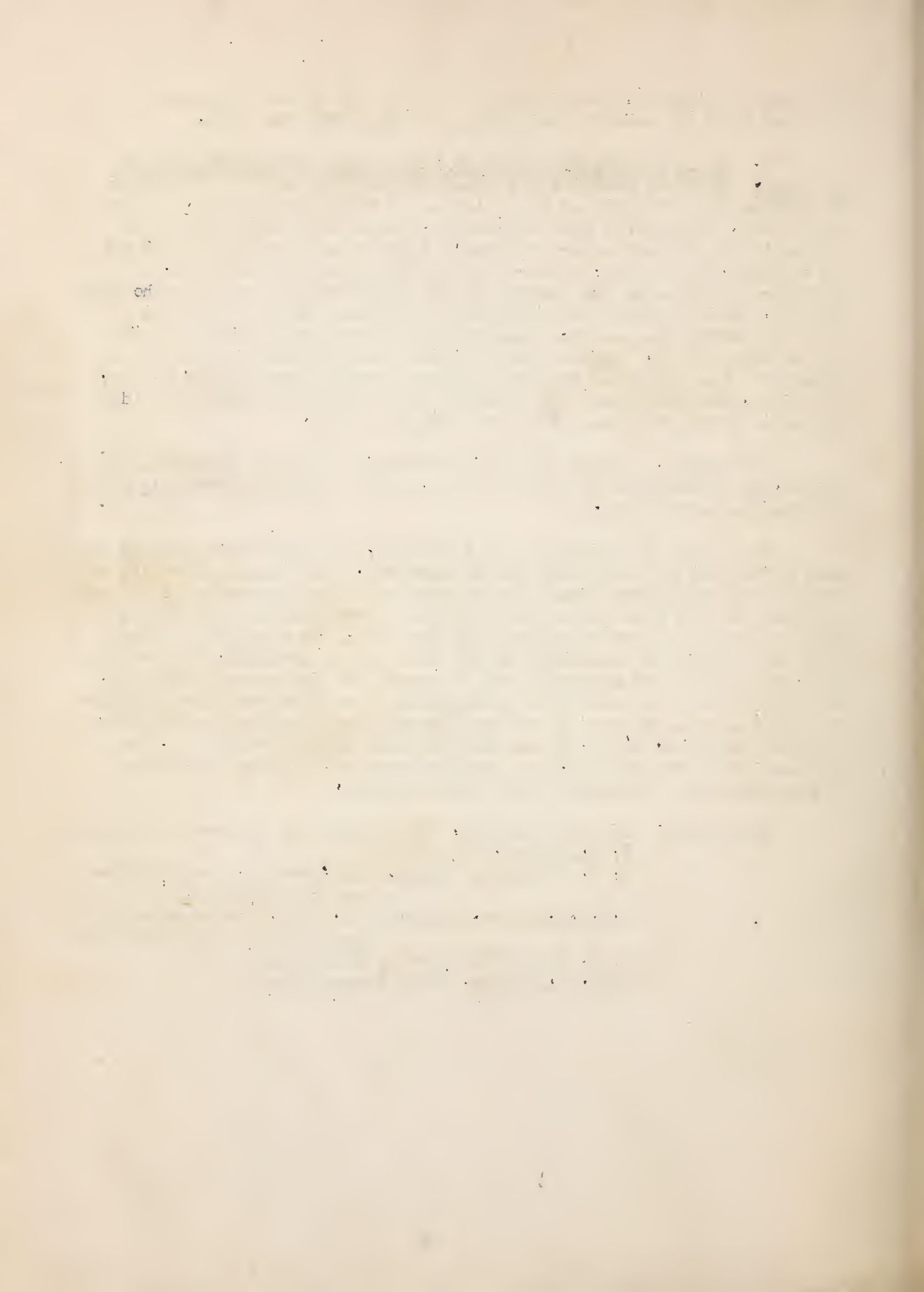


## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.

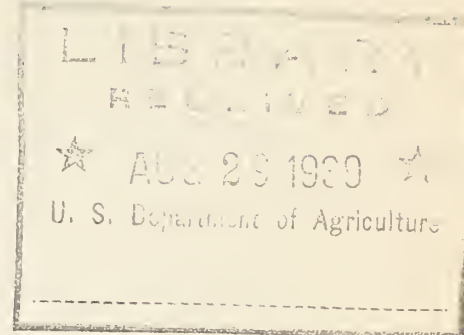


1.7608  
R26  
no. 55

#908

U.S. Library

UNITED STATES DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE  
Region 8  
Albuquerque, New Mexico



- - -

Hugh G. Calkins  
Regional Conservator

- - -

NATIVE LEGUMES IN REGION 8

By  
Leslie N. Goodding  
Associate Botanist  
Nursery Section

Regional Bulletin No. 55  
Plant Study Series No. 1  
April 15, 1939



## INTRODUCTION

There has been considerable discussion recently, about available legumes for use on our depleted ranges. The natural tendency is to look to other regions, or to foreign countries, for the answer to our problems. We find, however, that such plants as the Lespedezas, Kudzu, clovers, and alfalfas are suited only to cultivated land or sites at such elevations that sufficient rainfall is assured. The following report has been assembled with the hope that attention may be focused on our native legumes. Since we have many species, it may be that we shall be able to find certain species suitable to each of our varied conditions and problems. There is no thought in assembling this information that even a major part of these plants will prove serviceable. There may be those who can judge a plant in its natural setting and definitely assign it to its place in oblivion. The writer has no such acumen. It is safe to say, however, that the following list includes plants which will take their places among our important range and farm crops in the future.

Is it out of reason to look forward to a time when extensive experimental work can be undertaken? Our legumes need intensive study. It is hardly sufficient to have special studies on certain of the Lupines, or perchance, the Metcalf bean. The short discussion of the genus, Astragalus, must indicate that no "hit or miss" work with that group will yield satisfactory results. One man could



devote his undivided attention to the legumes, and outline and encourage work at the experiment stations and plantings in our observational sites. Work of this caliber should be productive of lasting result to range management and to agronomy.

To facilitate the work of the field man interested in the legumes, a key has been worked out. An index is also appended.

### WHAT PLANTS ARE LEGUMES?

In general, we all know legumes when we see them. We know that peas and beans of all sorts belong in this group. Considered here, however, are some plants which might not at first thought be so considered. In fact some taxonomists place them in separate families. Perhaps the best way to get the association in your mind is to mention a few of these with which we are all familiar. The Mimosas, or sensitive plants so common in the southwest and commonly called Catclaws, are considered here among the legumes, as are the Mesquites and the true Catclaw (Acacia greggii). We consider here also the Redbud, the Cassias or Sennas, the Partridge peas, and the Hog Potato. Still another group contains the Rhatanies, those strange shrubs with the short heart-shaped prickly pods. With this generalization, the following key will help to locate your legume more exactly. It is possible that your plant is not a legume if the key fails to work.







## I - Mimosaceae

Herbs, shrubs or trees with leaves which are usually once or twice divided i.e., 1-2 pinnate, flowers in dense heads or catkin-like spikes. The flowers are regular i.e., the petals are all alike; the calyx has 3-6 lobes; the corolla has a similar number of lobes or divisions; the stamens may be the same number as the corolla lobes, twice as many, or numerous; and the fruit is a pod.

Stamens numerous i.e., more than 10

Stamens united by their filaments

Pods opening elastically, the valves or halves remaining attached at the base . . . Calliandra

Pods not opening elastically . . . . . Lysiloma

Stamens free . . . . . Acacia

Stamens as many as the corolla lobes, or twice as many

Flowers with five petals, each anther tipped with a gland, pods indehiscent,

shrubs or trees

Pods spirally coiled . . . . . Strombocarpa

Pods elongated, not coiled . . . . . Prosopis

Flowers with 4 or 5 petals, anthers not gland tipped, pods deluscent

Leaves sensitive, pods somewhat 4-sided, leaves and stems with small

recurved spines, decumbent plants . . . . . Morongia

Leaves not sensitive, or tardily so, pods flat

Plants without spines, somewhat shrubby . . . . . Desmanthus

Plants armed with numerous recurved spines, shrubs . . . . . Mimosa

## II - Cassiaceae

Herbs, shrubs or trees with simple or divided leaves; stamens 10 or less, free or united; fruit a legume or pod opening by 2 valves. Flowers irregular, though sometimes only slightly so, the upper petal narrow and enclosed in the lateral ones in the bud.

Trees or tall shrubs

Leaves simple, cordate . . . . . Corcys

Leaves compound, pinnate

Pods round, constricted between the seeds . . . . . Parkinsonia

Pods flat . . . . . Cercidium



## CASSIACEAE (Cont.)

Low shrubs or herbs

Leaves twice divided i.e., bipinnate, low herbaceous plants or slender

shrubs with strict, almost broom-like habit . . . Hoffmanneggia

Leaves once divided i.e., pinnate

Corolla almost regular, some stamens abortive, calyx lobes obtuse . . . Cassia

Corolla irregular, the lower petal noticeably longest, none of the

ten stamens abortive . . . Chamaecrista

## III - KRATERRIACEAE

Shrubs or suffrutescent herbs with simple leaves, irregular flowers and short indehiscent heart-shaped pods with barbed spines . . . Krameria

## IV - FABACEAE

Herbs, shrubs, vines or trees with alternate, usually compound leaves; flowers irregular, the wide upper petal (banner) enclosing the two lateral wings in the bud; fruit a legume or loment (a pod made up of distinct divisions each containing a single seed.)

A. Stamens 10, distinct

a. Leaves pinnate . . . . . Sophora

aa. Leaves digitate, ours trifoliate . . . . . Thermopsis

AA. Stamens monodelphous (All attached together by their filaments) or diadelphous (one being free.)

a. Herbs, shrubs, woody vines or trees, leaves without tendrils

b. Pod not a loment, 2-valved or indehiscent

c. Foliage not glandular dotted. (Glycyrrhiza with many seeded bur-like pods; and Eysenhardtia with short flat pods and dense spikes of white flowers, are exceptions.)

d. Anthers of two kinds, stamens monodelphous i.e., attached into one piece by their filaments.

e. Annual herbs with 3-foliate leaves and yellow flowers . Crotalaria

ee. Annual or perennial herbs with digitately several

foliate leaves and white, blue or purple flowers . . . Lupinus

dd. Anthers all alike, stamens diadelphous or monodelphous





# FABACEAE (Cont.)

- e. Leaves 1-3 foliate (possibly 5-foliate)
- f. Leaves denticulate . . . . . Trifolium
- ff. Leaves entire or occasionally the leaflets lobed,  
not denticulate
- g. Herbs, sometimes suffrutescent with small  
leaflets, yellow or orange flowers . . . . . Lotus
- gg. Herbs, vines or one a thorny shrub. Leaves  
trifoliate, the leaflets usually large, pre-  
dominantly vines.
- h. Shrubs with long scarlet flowers and long pods  
with bright colored beans . . . . . Erythrina
- hh. Herbs or vines.
- i. Keel of corolla not curved or coiled
- j. Style bearded along the inner side,  
rachis not thickened at the insertion  
of the flowers . . . . . Clitoria
- jj. Style glabrous or pubescent below
- k. Flowers blue, purple, purplish or  
white, calyx tubular, bracteolate . . . . . Galactia
- kk. Flowers yellow or orange . . . . . Rhynchosia
- ii. Keel of corolla curved or coiled,  
flowers in racemes, rachis thickened  
at the flower insertion . . . . . Phaseolus
- ee. Leaves pinnately several-many foliate
- f. Spiny herbs . . . . . Peteria
- ff. Trees, shrubs or herbs, no spiny herbs
- g. Standard very broad, ovate or obicular (corolla  
nearly regular in Eysenhardtia.)
- h. Shrubs or trees, leaves odd pinnate
- i. Shrubs (Eysenhardtia is occasionally a  
small tree), thornless
- j. Pods very short, almost spherical . . . . Indigofera
- jj. Pods flat
- k. Flowers small white, in dense spikes,  
pods short flat, foliage glandular  
dotted . . . . . Eysenhardtia
- kk. Flowers larger, pinkish, scattered,  
pods slender . . . . . Coursetia



# FABACEAE (Cont.)

- ii. Trees or large shrubs, thorny
- j. Thorns straight, flowers pink to whitish . . . Robinia
- jj. Thorns short curved, flowers purplish white . . . Olneya
- hh. Herbs
  - i. Pods slender flat and constricted between the seeds, appearing cross-marked . . . . . Benthamantha
  - ii. Pods slender but not constricted or cross-marked . . . . . Tephrosia
- gg. Standard narrow, all herbs
  - h. Pods smooth
    - i. Keel (formed of the two lowest petals) prolonged into a beak . . . . . Oxytropis
    - ii. Keel not prolonged into a beak . . . . . Astragalus
    - hh. Pods prickly . . . . . Glycyrrhiza
- cc. Foliage glandular dotted, pods indehiscent 1-2 seeded
- d. Leaves digitately 3-5 foliate, or pinnately 3-foliate . . . . . Psoralea
- dd. Leaves pinnately several-many foliate
  - e. Stamens 10 or 9 united at least at the base
    - f. Corolla absent . . . . . Parryella
    - ff. Corolla present
      - g. Corolla of but one petal . . . . . Amorpha
      - gg. Corolla of five petals, wings and keel attached to the stamen filaments . . . . . Dalea
  - ee. Stamens only 5, monodelphous . . . . . Potalostemon
- bb. Pod a loment, i.e., pod jointed, suffrutescent herbs, herbaceous or woody vines
  - c. Leaves odd pinnate, leaflets several to many per leaf
    - d. Woody vines in which the terminal segment of the pod is samara-like . . . . . Missolia
    - dd. Herbs, suffrutescent herbs, or vines
      - e. Flowers purple or purplish or white in spicate racemes . . . . . Hedyсарum
      - ee. Flowers yellow, small, leaves sensitive . . . . . Aeschynomene
  - cc. Leaves simple or trifoliate, flowers purple, blue or white, pods with several joints . . . . . Desmodium
- aa. Vines, leaves even pinnate, terminated by tendrils
  - b. Style slender with a tuft of hairs at the summit . . . . . Vicia
  - bb. Style flattened, bearded along the inner side . . . . . Lathyrus





Calliandra. All the Calliandras reported in the United States occur in the southwest. They range from western Texas to southern Arizona. They are shrubs, or at least woody at the base; the flowers are in globose heads; the stamens are many in each flower, united by their filaments into one piece, and are exserted well out of the flower; and the flat pods on ripening open at the end and elastically spring out, remaining attached at the base.

Calliandra eriophylla, bastard mesquite, or fairy duster, is a shrub occasionally three feet high but more frequently due to grazing, a few inches. The roots are large, woody and mostly horizontal, and the crown is spreading. In many places in southern Arizona it is abundant, the pinkish red flowers mottling the landscape during the blossoming season. God looked down through the ages and saw the plight of the hungry Arizona cow about the 15th of June, and decided to plant a shrub which, in spite of terrible abuse, would still continue to grow and supply food. The fairy duster is a gift from heaven to the cow, to the man who owns her, and to the country man has, and is abusing. It is hoped that we will be able to learn how to collect seed to advantage, and propagate this plant on the wilds so as to greatly increase its range.

Calliandra humilis extends farther to the north than C. eriophylla, occurring in the mountains about Prescott and Jerome, Arizona. It occurs also in New Mexico and Mexico. It is for the most part herbaceous, only the base being woody. The root system, while being horizontal and woody, will not protect the soil as well as C. eriophylla. Neither will the plant withstand grazing so well. While it is not comparable in virtues to the fairy duster, it may be suitable to higher elevations and hence to a wider range. In local areas it is abundant.

Calliandra reticulata is similar to C. humilis but has coarser leaflets and a more woody base. The leaflets are very reticulate i.e., the veins are prominent. This species is abundant in protected areas in the foothills of southern Arizona and is a good soil binder. It will not withstand heavy grazing.

Calliandra schottii is a shrub of very different habit from the above described species. It has numerous straight stems in a close bunch arising from a tangle of long woody roots, each one of which is like a smooth hard rope. It has a truly remarkable root system, calculated to hold the plant to the earth and make the earth stay put. The tops are tender, and often freeze back in the Baboquivari Mountains, apparently the only place the plant grows in southern Arizona. Freezing back, however, doesn't seem to bother the plant seriously, as it immediately sends out abundant new shoots. The tender tops are browsed by stock. We know nothing of the propagation of this plant. Patience, me Lord!



Lysiloma thornberi apparently is the only Lysiloma in the southwest. It is so rare as to be little known. The globose heads of white flowers, the bipinnate leaves, and straight flat pods cause it to be confused with the thornless Acacias. A critical examination of this plant will reveal that the stamens are united at their bases in contrast to those of Acacia, which are free. The large finely divided leaves make this a desirable ornamental for roadside planting in the warmer sections of our region. It also produces an abundance of seed which is doubtless good bird food.

Acacia. The Acacias, native to the United States, are almost without exception confined to the southwest. The hot bed of the world for this genus is Australia, where there are hundreds of species, many of them important trees. Some of these have been introduced to California and to many parts of the south. Of the several species in our region, two are frequently trees, some tall shrubs, and several low bushes.

Acacia farnesiana is a tree so widely cultivated throughout the tropical and subtropical world, and so widely escaped, that the real origin of it is not known. It is native to Texas but is likewise native to the Baboquivari Mountains and Sycamore Canyon (Santa Cruz County), Arizona. It is a beautiful ornamental with dark green, finely divided leaves, white thorns, and plump black pods. Decoctions of the seeds, bark, leaves, pods or flowers are authoritatively reported to cure every disease of man from corns to insanity. The Nursery Section does not plan to grow it as a medicinal tree, but as an ornamental along highways in warm regions it should be excellent.

Acacia greggii, or common catclaw, is sometimes a tree though more frequently a large shrub. The claws are recurved and extremely unfriendly to the traveller. The flowers, unlike most of our Acacias, occur in spikes resembling catkins. These are fragrant and the source of the best, or one of the best of the honeys of the desert. The seeds are important wildlife food. The catclaw grows along rocky washes generally, and is a great impediment to high water as the roots are long and very tenacious, as well as deep. The bushes are usually sprawling and frequently accumulate great masses of sticks, rocks, and other debris. This plant is not held in high favor by soil conservationists. Careful consideration of it, however, may show that it is well adapted to rocky sites in the foothills where floods become torrential. It should be mentioned that catclaw wood is excellent fire wood and not infrequently used by farmers and ranchers for doubletrees and singletrees, as the wood is extremely strong.

Acacia constricta paucispina. On much of the caliche land in southern New Mexico and southern Arizona this is the dominant shrub species. Occasionally it is a slender tree 20 feet or more tall. The term "paucispina" means few spines, which is a misnomer, as more often than otherwise this species is well fortified with long straight white spines. The flowers are in bright yellow balls





and frequently the air for miles is laden with this very pleasant sweet odor.

Acacia millifolia seems limited in its distribution. It is abundant on the limestone hills east of Douglas, Arizona. Here it is a shrub 3-5 feet tall. It has very finely divided leaves and small leaflets. The flowers are white, in globose heads, and the pods are straight, very thin and more than one-half inch wide. In this region it seems to be browsed probably by sheep. Considering the extremely dry site, this shrub should prove worthwhile in highway work and for erosion control on rocky slopes.

Acacia suffrutescens, A. shrevei, A. cuspidata, and A. lemmonii, are all Acacias of Arizona and New Mexico, of much the same habit. Frequently they are important soil binders and browse plants. They are suited to planting in the foothills and lower mountains of the southwest and should make desirable highway and ornamental plantings. They are also bird food plants. These species are being, or will be grown in the nursery at Tucson, and the desirable features of each species determined. At present our knowledge is quite limited.

Acacia sp. from the Florida Mountains south of Deming, New Mexico, is a pygmy bush resembling a Desmanthus. Its very low ground-hugging habit may make it valuable. It has not been grown in the nursery.

Strombocarpa pubescens. The screw bean is one of our neglected treasures. In the days of the Indian wars the beans of this tree had a ready sale at the forts for horse feed, where it was much more highly prized than the mesquite beans. It was considered a very satisfactory substitute for grain. This tree is no better and not much worse than mesquite as a soil binder. It does not, however, grow densely enough to preclude grass, and withstands much more alkali. This tree should be made the subject of careful study in selection and breeding through a long series of years. Perhaps investigators could be induced to work on several species of leguminous trees simultaneously.

Prosopis glandulosa. Reams might be written about our mesquites. By some they are considered plants sent direct from heaven. Others are not so sanguine of their value. In many places they certainly occupy sites which should be given over to grass under proper land management, and their much touted forage value isn't so evident to the man whose cattle are starving to death in mesquite groves. Mesquites are too often weeds. On the other hand, the value of the hundreds of tons of beans produced annually on which cattle fatten, must not be overlooked; neither should the revenue which accrues from the sale of wood. P. glandulosa is not our best mesquite as it is usually low and brush-like. It, however, produces great quantities of excellent fuel. In many places this must be mined from sand hills instead of cut in the forest. Work should be undertaken in the selection of strains which produce large and





nutritious pods. Even breeding does not seem out of order.

Prosopis velutina is much more commonly a tree. In fact in sites along the bottom lands where for one reason or another trees have been protected from the wood cutter, they may be found 30 feet high or even more, and 2 - 3 feet in diameter. The southwest has not yet awakened to the possibilities of utilizing the wood of these trees for anything other than firewood or fence posts. The fact is that the heart wood of the mesquite is comparable to walnut in beauty. It takes a beautiful polish and lasts forever, - well, almost. For bric-a-brac and furniture it is hard to excel. Withal, mesquites, particularly this species, cannot be considered good soil binders. In dense stands they tend to preclude vegetation much better adapted to binding the soil.

Morongia occidentalis, or Sensitive Brier, occurs in eastern New Mexico, usually in bar pits. It is a rather showy vine with finely divided leaves, large balls of pink flowers, slender prickly pods, and perfectly nasty recurved spines on the stems, and even on the rachises of the leaves. It should prove of value as a highway ornamental.

Desmanthus. The members of this genus are also known as Acuan, or more commonly as Mimosa, though the last name confuses them with a different genus of plants. Two of our species are of much greater importance than we commonly consider them, both for erosion control and as forage. Those considered here are all shrubs or at least shrubby at the base. They are thornless, have finely divided bipinnate leaves, flowers in heads or spikes, and stamens which are exserted and free. The pods are commonly long and slender though sometimes curved, and occur in bunches.

Desmanthus jamesii is a prostrate vine or shrub often almost herbaceous. It is very common in the yellow pine and pinon and oak regions in Arizona and New Mexico. It frequently comes in on new road grades in abundance, and is effective in keeping the soil in place. It also occurs in generous mixture with grasses and constitutes a fair browse plant. In the nursery this and other species are infested by an insect that causes the pods to atrophy or form small seed-like knots instead of pods. The seed production is thus reduced greatly.

Desmanthus cooleyi closely resembles the last, and for our purpose may be considered with it. It is a more pubescent plant and for the most part grows at a somewhat lower altitude. This is badly infested in the nursery with the insect which attacks D. jamesii.

Desmanthus illinoensis is a common sight along the Rio Grande River, especially along railroad grades. It is an erect shrub 2-3 feet high with finely divided leaves and large bunches of short curved pods which become black as they ripen. This is a good erosion control plant but seems to be valueless as forage.



and frequently becomes a weed. It seems likely that this is an excellent wildlife plant since it produces seed in such great abundance.

Desmanthus virgatus. This shrub was recently collected by the Nursery Section in Santa Cruz County, Arizona, and in the Guadalupe Mountains in New Mexico. It has not been previously known outside of Mexico and the Florida Keys. The habit of the plants in the Guadalupe Mountains and of those in Santa Cruz County, are very different and when they are both grown in the nursery they may prove to be different. The one from Sycamore Canyon, Santa Cruz County, Arizona, is a vigorous but tender shrub with large leaves made up of very small leaflets. It has long straight pods. Plants at the nursery frequently freeze nearly, or quite to the ground. The plant from the Guadalupe Mountains is similar but is prostrate or nearly so, and perhaps more woody. These two plants should prove valuable as ornamentals along highways where there is sufficient moisture and where the winters are very mild. The seed is produced in abundance and doubtless forms tidbits for birds.

Mimosa. This genus is made up with us, of extremely thorny bushes. The thorns are recurved and perfectly vicious in their attack on the unwary. The leaves are bipinnate and the leaflets small. The stamens are ten and distinct. The flowers are borne in spikes or heads, and are yellow or pink.

Mimosa biuncifera is one of the very common catclaw bushes. It occurs from eastern New Mexico to central Arizona. In many places it forms pure stands covering hundreds of acres, and the low tree-like shrubs are often an effective barrier even to livestock. This is a good wildlife plant, producing seeds in abundance, and much shelter. It is to be recommended for planting only where grazing is to be discouraged. It must be remembered that the cowboy and his religion part company in catclaw thickets.

Mimosa dysocarpa is much less common than the one just discussed. It occurs in southwestern New Mexico and in southern Arizona. Two things readily distinguish this shrub from M. biuncifera. M. dysocarpa has spikes of pink flowers, very handsome, while M. biuncifera has heads of yellowish white flowers. M. dysocarpa has pods covered with very dense short hairs. These pods when ripe fall apart in segments, each segment containing a seed. This shrub is much better suited to ornamental planting and highway work but probably is not as good bird food as M. biuncifera because of the portions of pods which adhere to the seeds.

Mimosa lemmoni resembles M. biuncifera but is normally a smaller shrub. It has globose heads of yellowish flowers and pods with stout spines along the edges. It is comparatively rare in southwestern New Mexico and southern Arizona. This species is suitable





for highway plantings and doubtless is an excellent wildlife plant.

Cercis occidentalis. Few people in the southwest realize that we have a beautiful red-bud tucked away in our mountains. It has been reported from southern Utah, is almost common in the Grand Canyon, and by sufficient expenditure of sweat can be seen in the Superstition and Baboquivari mountains in Arizona. It is a large shrub or small tree with cordate leaves and pink to red flowers. It closely resembles the eastern red-bud. This is not a tree to be recommended for general planting but is suitable for yards, highways, and landscapes. If planted along the highways an extra police force will be required to keep vandals from picking the flowers.

Parkinsonia aculeata is one of the paloverdes. For several reasons it may be considered the outstanding one. It grows more rapidly and forms a more symmetrical tree and for street and ornamental plantings it is excellent. The tree can be recognized by its green branches and very long slender leaves with minute leaflets along the rachis. During dry times these leaflets disappear. This paloverde is common throughout Mexico and has been introduced to South Africa where it has escaped cultivation. It is recommended for highway and street plantings in southern Arizona and southern New Mexico.

Parkinsonia microphylla ranges from southern Arizona to southern California, and south into Mexico. Along with Cercidium torreyanum, it makes the foothills and mesas a mass of gold when in blossom. The color of the bark and the shape of the pods easily distinguish these paloverdes. The bark of P. microphylla is tinged with orange and the pods are round and constricted between the seeds. In C. torreyanum the bark is pale olive green on all except the old trunks which become reddish brown and roughened. The pods are flattened and are not constricted between the seeds. P. microphylla seldom makes a tree, usually being a large or small compact shrub. West of Wickensburg, Arizona, some specimens rival in size C. torreyanum.

Cercidium torreyanum, as suggested above, is a low tree. Not infrequently it has a trunk  $1\frac{1}{2}$  - 2 feet in diameter and a very compact round crown. Along washes where there is sufficient moisture it retains its leaves for long periods and is one of the striking features of the landscape. Nurserymen and landscape gardeners should court this tree. While it is slower growing than Parkinsonia aculeata, it makes a more compact tree,- one which will stand up and make a shadow. Its natural range is southern Arizona to southern California but it is adapted to a much wider range.

The paloverdes yield an abundance of seed for wildlife as well as for stock. Formerly the seeds were used by the Indian in the same way that mesquite beans were used. The wood is rather poor even for fire wood. That of Parkinsonia aculeata has been used for the manufacture of paper, according to Standley in "Trees & Shrubs of Mexico."





Hoffmanzeggia densiflora, or hog potato, is a very common weed in the southwest, frequently making a complete ground cover along highways, on the grades, and in the bar pits. It also occupies waste fields where the soil is very poor. It can be recognized by its spikes of yellow to red flowers and its finely divided leaves. The plants are not commonly more than ten inches in height. This lowly weed has almost everything. It is a soil binder; it is palatable to stock; it is drought resistant; it binds the soil; and its roots are excellent food for man or beast. They were formerly used extensively by the Indians. Why this has received so little attention is a human puzzle.

Hoffmanzeggia jamesii in leaf character, resembles the one just described. The leaves and fruits, however, are speckled with black glands. This plant has about the same general range as H. densiflora but is much less important, the plants not generally forming such complete stands and the roots being very woody.

Hoffmanzeggia microphylla is a species of no significance as far as known. It grows in very hot dry regions and is very scattering in its habit. The plants are erect, 3-4 feet tall, and almost leafless most of the year. The curious may see it along the highway in a very few spots, between Wellton and Yuma, Arizona.

Hoffmanzeggia sp. An important weedy species occurs above the highway east of Aguila, Arizona. The Nursery Section does not at present have an identification of this. It resembles H. jamesii and may be that species. It forms a dense ground cover on the gravelly road grades in very poor soil.

Cassia. This genus contains several very important medicinal plants. The Senna, so common on the market as a laxative, is derived from a tropical senna and it is not unlikely that one of ours has similar properties. The seeds of probably all our species are wildlife food and some may even be fit for human consumption. Their use for food or medicine, however, must await careful research. This genus is often placed in the Cassiaceae, a separate family from the true legumes, because of its almost regular flowers and distinct stemens. The Cassias have pinnate leaves, some have but two leaflets to the leaf, but most have several to many. None of ours are browse plants, nor particularly good erosion control plants, but for wildlife and as ornamentals they are good.

Cassia wislizeni is a true woody shrub with small dark green leaflets, large sweet scented flowers, and long, somewhat tortuous slender pods. It is abundant on the low limestone hills east and west of Douglas, Arizona, and extends eastward into southwestern New Mexico and south into Mexico. It thrives in cultivation and





makes a handsome ornamental. It is recommended for ornamental and highway planting in regions where the winters are not too rigorous.

Cassia leptocarpa. Our plants may represent a distinct species from the true C. leptocarpa which is South American. Ours is herbaceous but is bushy in habit and often 3 or 4 feet tall. It has coarse pinnate leaves (the leaflets of which taper to long points), and large yellow flowers in spikes. The pods are 8-12 inches long, very slender, and are produced in great abundance. The seeds are choice quail food. This plant is so prolific in seed production that it suggests itself for cultivation. It is not unlikely that a crop comparable to a good wheat yield can be produced on bottom lands without more irrigation than that obtained by a natural flooding. The seed should be excellent food for all kinds of fowls, if not for livestock. Tests should be made of the seeds and leaves for the properties found in the commercial senna. This species is the one so abundant along the highway below Dragoon Pass east of Benson, Arizona. It is recommended for highway and wildlife plantings. The leaves have a disagreeable odor, making the plants undesirable in yards.

Cassia covesii is an herbaceous perennial with oblong grayish leaflets, 2 or 3 pairs to the leaf. The plants are very variable in size, depending on the moisture available. Frequently plants are 2 feet high or more, with a similar spread. The pods are short but produce in abundance and for a very long season. This species ranges from southwestern New Mexico to southern Arizona and northward into Mexico. It is of no value as forage, has little erosion control value, is not highly ornamental but may have a place as a wildlife plant. It grows in very dry, rocky sites.

Cassia lindheimeriana is comparable to C. covesii. It ranges from western Texas to Arizona but is not common in Arizona. It has longer, more slender leaflets, and much longer pods than C. covesii. Its only possible value outside of medicine is for wildlife.

Cassia bauhinioides is similar to C. lindheimeriana but has only two leaflets to the leaf. It has a similar range and can be recommended only for wildlife.

Cassia roemeriana, like C. lindheimeriana, has but two leaflets to the leaf. These are lanceolate and about 5 cm. long. What applies to the last mentioned species applies equally to this one. It is not found in Arizona.

Chamaecrista leptadaenia is familiar to many as the partridge pea. In the "Notes on Native and Exotic Plants in Region 8", this was called C. nictitans. It is a low erect or ascending annual with finely divided leaves, small yellow flowers, and narrow,





abundant, almost erect pods. The range of this particular species is from western Texas to southern Arizona. On the east slopes of the foothills of the Santa Rita mountains, for example, it occupies overgrazed areas and forms a quite dense cover. It seems to be low in palatability. The abundant small peas should be excellent wild-life food.

Chamaecrista wrightii? occurs in southern New Mexico, southern Arizona and Sonora. It is a low perennial herb closely resembling the last but having large showy yellow flowers. It is seldom abundant but has an excellent root system with divided crowns. With human persuasion it may become an important conservation plant, as well as a worthwhile ornamental.

Krameria. Several Rhatanies occur in the southwest. They are readily recognized by the very short, heart-shaped pods covered with spines and by the slender, grayish leaves. The spines are barbed. Several species are spinescent. The roots of some of the South American and Mexican species are used medicinally and are sold under the name Rhatany. They were formerly used for making a dye and to manufacture ink. The southwestern species are probably similar in properties to the Mexican species but apparently they have not been commercialized, though the Indians extracted a dye from them. The Rhatanies are important browse plants and where sufficiently abundant are excellent soil binders. They are difficult to raise in the nursery because of their parasitic nature or what is more likely, their dependence on other plants symbiotically. Tests are being conducted in the nursery at Tucson at present, in planting seed in association with other plants; also in planting them in definite mixtures to determine methods by which they can be successfully propagated in the field.

Krameria glandulosa is common on the foothills from Texas to Utah and California in the United States; and from Chihuahua to Lower California in Mexico. It is a shrub often 3 feet in height and has as wide a spread. The stalks of the flowers are glandular. This shrub is inferior to the following for browse or for erosion control. No recommendations for its use can be made at present.

Krameria secundiflora is a low shrub appearing prostrate. It has widely spreading roots and crown which become thick and very woody, while the upright portions are herbaceous. It is an exceptional soil binder and a good browse plant. Unless land is persistently overgrazed it holds its own. This species has been observed in southern New Mexico and southern Arizona on a great variety of sites, from sandy bottoms, land with considerable alkali, (as found in parts of the Sulphur Springs Valley), to very rocky, gravelly volcanic soil, (as found in Santa Cruz County, Arizona). A desperate effort to use this plant in revegetation work should be made. It is not unlikely that the roots could be used as



Rhatany on the drug markets.

Krameria grayi resembles K. glandulosa, and doubtless is often confused with it. The flower stalks of this species are not glandular. It is probably inferior to either of the above-mentioned species as forage. It has a similar range.

Sophora. In some other parts of the world the Sophoras are more abundant and of greater size than ours. Some of ours are herbaceous and one is occasionally a tree though more often a shrub. The seeds are reported to be poisonous. Plants generally, however, are not palatable.

Sophora secundiflora is confined in our range to Texas and southeastern New Mexico. It is a shrub or small tree with very thick, pinnate, bluish green, evergreen leaves, and large spikes of blue flowers. It is a beautiful shrub which grows by choice along dry rocky arroyos. The seeds are large and very hard and require treatment by filing, acid or hot water, to induce germination. This shrub should have an important place in highway planting and in yards. The seeds and probably the leaves are poisonous but what is the difference, nothing eats them.

Sophora arizonica, as far as is known, is confined to Arizona. South of Pima and on the Bill Williams and its tributaries, it is abundant. While this can only be classed as a shrub because of habit, it still attains a height of 15 feet or more. Clumps are frequently composed of many stems arising from a crown, and the tops are often 15 to 20 feet across. The flower clusters of this species are less conspicuous than those of the last but are nevertheless very handsome. The leaves are thick and evergreen. It is recommended for highway and ornamental planting.

Sophora stenophylla is reported from the San Andreas Mountains in New Mexico and from northern Arizona and southern Utah. It is found in abundance in the drifting sand out of Toquerville, Utah. The low plants in dense stand give a silvery silky sheen to the landscape. The leaves are finely divided and the flowers light blue, in dense spikes. It is easy to mistake this plant for an Astragalus. The stamens of Sophora, however, are free instead of united into two sets as in Astragalus. This plant is a remarkable sand binder but may have to be placed on the taboo list because of its poisonous seeds.

Sophora sericea is a widely distributed herb, very common in open grassland regions of eastern Colorado and northern New Mexico. Like the last mentioned species, it is herbaceous and easily confused with Astragalus. It has divided leaves with narrow divisions and spikes of whitish flowers. As a soil binder it rates high but it must be considered a troublesome weed in many places







and be held in suspicion as a poisonous plant.

Thermopsis montana is a plant resembling a lupine in general appearance except that the flowers are yellow, usually somewhat larger and the leaves trifoliate. It is confined to the yellow pine belt approximately, in our western mountains. The species of this genus and their ranges seem to be poorly understood, and we may assume that the name here applied really represents three or more species. The plants are perennial herbs arising from root stalks which make excellent soil binders. Frequently considerable areas are covered by these plants. They are browsed to some extent but are suspected of being somewhat poisonous. One specimen of this plant collected near Prescott, Arizona was observed to have an extremely tough fiber in the stems. The altitude at which these plants grow, their moisture requirements, and the fact that they are suspected of being poisonous, precludes the possibilities of their use until they are better understood.

Crotalaria lupulina, or rattle-box, was reported by Professor Thornber of the University of Arizona some years back, to be good forage. It is an annual with bright green leaves, yellow flowers streaked with red or purple, and short inflated pods. Seasons of abundant winter or spring rains bring it on in abundance in southern New Mexico and southern Arizona, especially along sandy draws. When undisturbed it usually ripens and dies by early fall but often where browsed it puts on vigorous fall growth and makes a late seed crop. In the nursery this has proved a surprising plant. Instead of its usual spindly self it formed dense, very leafy plants, 2 to 3 feet tall, suggesting its use as a cover crop in orchards or as a green manure crop.

Lupinus. The lupines are much more appreciated in Germany and Russia, and possibly other European countries, than here. The chief difficulty is that our lupines have not been studied, some are poisonous, and some are insignificant. On the other hand, some are known to be heavily browsed without injury to stock. It is not likely that our information will be complete for years. Careful tests must be conducted to determine which ones are safe. This work must be followed by selection and perhaps breeding. Much of this work the nurseries are in no position to undertake. Collections of specimens and of seed are being made, and in cooperation with the Division of Forage Crops and Diseases in Washington, we hope to acquire information which will permit the use of certain of our lupines.

Trifolium. Commonly we think of cultivated field crops when we speak of clover. We have, however, many wild clovers, some of which are very important. They are especially important at higher altitudes where there is more moisture available than we have under normal desert conditions. The clovers of the southwest have received



very little attention, especially by the Soil Conservation Service. What follows can be only slightly suggestive.

Trifolium brandegii is a low mountain clover very common in many parts of the Rocky Mountains. This is frequently called Spruce Clover, indicating that it grows in the spruce timber. It does, but also grows at much lower elevations where there is sufficient moisture. This is an excellent soil binder and highly palatable. According to Jesse Mann of the Soil Conservation Service, it thrives on abuse.

Trifolium fendleri is another clover confined to moist places in the mountains. It grows at lower altitudes than the one discussed above but only where there is constant moisture in the soil. In such places where there is very little or no alkali, it forms a solid sod which holds the soil even during heavy floods. It also withstands quite heavy abuse. We have done no work with this species. Its use can at best be but very limited.

There are, as has been suggested, other clovers within our range. Some of these deserve to be studied. Two species were collected in dry sites on Highway 60 south of the Salt River crossing in Arizona. These may be escapes from cultivation. They are, however, not among our most common clovers. They are promising annuals. More may be said of these in the future.

Lotus. The Bird's-foot Trefoil, of which there are several species in the southwest, are among the characteristic plants of the desert and semidesert. In many places they are abundant and constitute a significant part of the vegetation. More often, however, they are quite scattering. All seem to be somewhat palatable though they do not rate with many of the other legumes. The group as a whole, should be studied and selections showing the highest palatability and the best soil conserving characteristics, should be tried in the nurseries and on the range. For example, a plant as important in erosion control as the California Deer Clover, Lotus scoparius, should be used extensively in revegetation work where it is adapted. A comparable though probably inferior species with us, is Lotus rigidus. We may find that with selection and possibly breeding, we can get desert species comparable for our work, to Lotus corniculatus, so extensively used in Europe. All of our Bird's-foot Trefoils have yellow or reddish orange flowers and pinnate or palmate leaves. Some are shrubs, a few are annuals, and many are prostrate. The following probably constitute the more important ones in our range. The list is not complete, however, and some excellent species may have been omitted.

Lotus rigidus ranges from New Mexico to California, and Utah. It is somewhat shrubby in our southwest ranges. The young stems and leaves are bright green, and the flowers bright yellow except where





marked with red. This species grows in a wide range of conditions, being found in moist sites up to altitudes of 5,000 feet, and in dry rocky sites at low elevation where the rainfall is less than three inches, as in the Tinajas Altas mountains. On the south slopes of the Catalina Mountains this species is abundant and quite heavily browsed. Its erect bushy habit makes it inferior to some other species as a soil binder.

Lotus wrightii. It is highly probable that plants we are considering under this species represent more than one species. The variation in plants, as well as in altitudinal range, is too great. This is one of the erect forms with considerable variation in leaf pubescence. We have observed it at Duck Creek in south central Utah, at Cedar City, Utah; in the Hualapai Mountains, at Prescott, Jacobs Lake, and Flagstaff in Arizona; and the Animas Mountains in New Mexico. This plant is abundant in many places and its heavy perennial roots with broad crowns make it a good erosion control plant. It is high in palatability and withstands grazing well. Selections should be made at different altitudes. This is a very promising species for revegetation work,- in fact it may be our best Lotus.

Lotus greenei is another erect or ascending, low bushy type Lotus, resembling L. wrightii. It is much more frutescent and grows at lower altitudes. In the pinon and oak belts, and below in the Huachuca, Santa Rita, Santa Catalina, and Baboquivari Mountains, this species is common, often abundant. It ranks very little below L. wrightii in soil conserving value and in palatability, and may prove more satisfactory at lower altitudes.

Lotus longibracteatus resembles the last two species. It was observed on dry rocky slopes in Stockton Pass in the Graham Mountains, and has a wide range in Arizona in similar sites. It is comparable to L. wrightii and L. greenei, but seems to be much less abundant.

Lotus alamosanus is a species not reported in the United States until recently. It must be common in parts of Sonora. In Sycamore Canyon, Santa Cruz County, Arizona, it is abundant. In habit and texture it is entirely different from the Lotuses described above. It prefers moist sites but climbs the stream banks to quite dry situations. The roots form a dense sod and the prostrate or ascending stems form a complete ground cover. It withstands terrible abuse in grazing, being frequently kept down to ground surface for weeks, only to spring up with opportunity. Thus far we have had poor luck in germinating and growing this species in the nursery. It should make a most excellent ground cover in orchards. Its use in erosion control, however, is limited by its moisture requirements and probably by the relatively high temperatures under which it thrives.

Lotus argyraeus. In our search for legumes adaptable to our dry





regions we must try many which will eventually prove failures. This species may be in this class. The only place we have observed it is on the dry rocky gravelly flats east of Hackberry, Arizona. In general appearance it resembles L. greenii but the stems are prostrate or ascending, thus making it a better ground cover. It is doubtless highly palatable.

Lotus humistratus is probably the same thing as L. trispermus, or is very closely related to it. Plants are low prostrate, very woolly annuals with yellow flowers. They frequently form a good temporary ground cover on waste land. Its range is from eastern New Mexico to California at altitudes of 3000-6000 feet. This species is probably of little value but it should be tried as a leguminous nurse crop.

Lotus hamatus. This species is only considered because of its drought resistance and the possibilities for its use on heavy, overgrazed soil in extremely hot deserts. It is a species known in our region only from the flats near Robles, Arizona. It is a prostrate annual with very peculiar pods which are curled up at the ends much like fish hooks.

Erythrina flabelliformis or Indian bean, is confined to warm canyons and rocky slopes in southern New Mexico and southern Arizona within our range. This is really a tropical plant. Not infrequently it freezes to the ground in our range but each year it sends up abundant new shoots. In regions where it does not freeze it becomes a small tree. The abundant large cordate leaves, long tube-like scarlet flowers, and pods as thick as a man's finger, 8-12 inches long, make this plant a striking feature of the landscape. In the late fall the pods crack open and reveal the scarlet or yellow beans. Persons ambitious to transplant small bushes are usually disillusioned for the roots on even small plants, are massive. The crown is frequently a foot or more across and when the earth is removed the crown and roots look like an octopus. Seeds remain in moist soil for years without germination but a gentle treatment of 5-10 minutes boiling will bring prompt results. Recommended for ornamental planting in very warm regions.

Clitoria mariana. By the ghosts on the River Styx, who would expect the butterfly pea of the Virginia woods to occur in the southwest! It is, however, almost abundant in places in the south end of the Chiricahua Mountains and in Sycamore Canyon in Santa Cruz County, Arizona, in the oak and juniper regions. It resembles somewhat the cultivated pea in texture but has no tendril and only a slight tendency to twine. The plants are erect, the blossoms are large and showy, and the pods short, rather thick and fleshy. Wherever this plant has been found the somewhat rhizomatous roots were abundant and formed excellent soil binders. This wild pea should be cultivated as an ornamental. It may also prove to be an excellent



cover and green manure crop. In Arizona it grows on rocky slopes usually where there is a little shade.

Galactia wrightii resembles the true beans. It is a trailer with trifoliate leaves, narrowly oblong grayish leaflets, and racemes of purplish flowers. The pods are  $1\frac{1}{2}$  - 2 inches long, very numerous, and full of seeds. Its range is western Texas, southern New Mexico, southern Arizona and Mexico, in canyons and rocky draws at comparatively low altitudes. It is an excellent perennial with abundant long stems which climb when there are bushes or rocks present. While it makes a good ground cover it apparently withstands grazing poorly. This is worthy of careful study as a cover crop in orchards or as a green manure crop. A plant closely resembling this species but with much broader, wider leaflets, occurs in Fish Creek Canyon, Arizona. This and G. wrightii will be given trial in the Soil Conservation Service Nursery at Tucson.

Rhynchosia texana is a leguminous vine with a woody perennial root and wide caudex. The leaves are trifoliate, the flowers yellow and in short spikes. The pods are short, flat and curved. A good sized vine will completely cover 3-4 square feet of ground. It occupies dry rocky land in the pinon and juniper belt in West Texas, southern New Mexico, southern Arizona and Mexico. R. texana seems to be low in palatability but is an excellent ground cover and soil binder. It responds well to cultivation and provides an abundance of seeds for wildlife. A plant collected near Oracle, Arizona, by Mr. Ed Morris of the nursery at Tucson, seems to have consistently larger and more lax leaves than the typical R. texana. This may prove to be a separate species or a variety.

Phaseolus. The true beans are usually thought of by the layman as limas, or navies, or Mexican, and they are associated in his mind with bacon, tomato sauce, chili, or molasses. Dr. Metcalf of Silver City a few decades ago tried cultivating the native bean which bears his name. His results were most promising but very little follow-up work was done with it until recently. He found that this bean produced a large amount of highly palatable forage. Several of our southwestern beans similarly produce much palatable foliage and frequently form a more or less complete ground cover. Not infrequently they produce seeds in abundance, suggesting that selection and breeding may produce worthwhile commercial crops. Just as they are, however, they are excellent forage, good erosion control plants where not overgrazed, and good wildlife plants.

Phaseolus metcalfii, P. retusus, and P. rhitensis.

These are all beans of the same general nature,- perennial trailers with large woody roots, large leaflets, and lima bean-like pods. It is doubtful if P. metcalfii and P. retusus are distinct species. These beans are confined to southwestern ranges and medium altitudes. They are frequently abundant in our oak,





juniper, and pinon slopes where the soil is rather loose. Not infrequently a steep slope where the soil is inclined to slide, is covered with these vines, the stems of which are often 10 feet long. These are the Kudzus of the southwest. Let's not be deceived, however. Neither these nor the true Kudzu will cover and heal gully cuts with our low rainfall.

Phaseolus macropoides in our range is confined to the mountains of southern New Mexico and southern Arizona. The Nursery Section records show that it occurs at Reserve Junction and Animas Mountains, New Mexico; and the Mule Mountains and Sycamore Canyon (Santa Cruz County), Arizona. It is not certain, however, that all this material has been properly identified. P. macropoides is a perennial trailer with large woody roots and numerous stems 2-3 feet long. The leaflets are oval but are frequently somewhat contracted between the middle and the tip. In parts of the Animas Mountains these beans form a considerable portion of the ground cover on dry rocky north-facing slopes where there is scattering oak timber. It produces beans in abundance about the size of lentils or smaller. The seeds are hard to collect, however, as vines bloom continuously for several weeks and the pods ripen similarly, a few at a time. This species thrives under cultivation.

Phaseolus dilatatus is another perennial bean quite similar in habit to the one discussed above. It grows at a slightly higher altitude and probably requires more moisture. The Nursery Section has records of its occurrence at the Alchesay Trading Post on Highway 60 in Arizona, the rim of the Mogollon Mesa above Young, Arizona, and in the Animas Mountains, New Mexico. In most respects this species resembles P. macropoides. The leaflets, however, are distinctive, the terminal one being broadly dilated at the base with the tip projecting like a short blunt handle. The lateral leaflets are broad at the base but taper almost evenly to the very blunt tip. This bean occupies sites quite similar to those in which P. macropoides flourishes.

Phaseolus angustifolius, collected by the Nursery Section in the Animas Mountains of New Mexico, is a perennial with very slender long leaflets which are smooth above and stiff-hairy below. All that can be said of this at present is that it is promising as a ground cover, for forage, and as a wildlife plant. It occupies dry sites in open oak timber.

Phaseolus angustissimus is another perennial vine observed in the Animas Mountains of New Mexico and Sycamore Canyon, Arizona. The leaflets are 2-3 inches long. The terminal one looks like a lance. The lateral leaflets are similar but are not symmetrical at the base, one side projecting to a broad v-shaped point. This vine forms considerable ground cover; produces pods in abundance; and is quite drought resistant. It is well worthy of careful trial. A similar





vine with rather coarse reticulate gray hairy leaflets, found in the Animas Mountains, appears to be a closely related species or a variety of P. angustissimus.

Phaseolus acutifolius is still another of our beans with long narrow leaflets. These are quite similar to those of P. angustissimus. The terminal leaflet has blunt symmetrical lobes at the base while the laterals have unsymmetrical bases, one side bulging out like a knob. This vine from Santa Cruz County, Arizona, makes a dense ground cover and is a prolific seed producer. It is being tried in the nursery at Tucson.

Phaseolus sp. A species of bean with very numerous slender stems, small narrow scabrous leaves, and short flat, slightly curved pods, was observed near the Salt River Crossing, Highway 60, Arizona. It is a perennial which grows in the bar pits and in the loose soil at the base of rocky cuts. It is so prolific and produces so much ground cover as well as innumerable pods, that it looks very promising for erosion control, wildlife, and possibly as a leguminous ground cover or green manure.

Peteria scoparia is a very thorny small bush with greenish flowers tinged with pink. The stems are erect, somewhat broom-like, the leaves pinnate, and the flowers in rather long spikes. Coulter reports that the plant produces tuberous root stalks which are edible and known in western Texas as Camote de monte. In Arizona and New Mexico the plant seems to be very rare. In Arizona it occurs in deep sand and in the Petrified Forest. We must get our goose before we can roast it. At present we have no seed from which to propagate the plant for trial.

Indigofera sphaerocarpa is a shrub 2-4 foot tall with narrow spikes of small flowers and very short almost sessile pods. The leaves are pinnate, with leaflets about one-half inch long. A curious feature of the hairs on the leaves will help to distinguish an Indigofera from other plants. The hairs are straight and seem to be flat on the leaf. If you will examine one of these under a hand lens you will find that it is fastened at the middle instead of the end. This species is confined to southern Arizona and probably southwestern New Mexico within our borders, but extends far into Chihuahua and Sonora. It is quite heavily browsed and is a fair erosion control plant for dry north-facing slopes at medium altitudes. It will probably freeze out as far north as Albuquerque.

Eysonhardtia orthocarpa in our range is confined to southern Arizona and a small portion of western Texas, but it extends to southern Mexico. We seem to have no common name for this unique tree. The Mexicans, however, have many names for it. A good one is "Palo dulce". With us it is a very small tree with pinnate leaves and small dense spikes of small white flowers. It is frequently





abundant on dry rocky ridges in the foothills of the Santa Ritas and other southern Arizona ranges. Always where accessible to stock, particularly horses, it is heavily browsed. It will, however, withstand severe abuse, sprouting freely from the butts and mutilated trunks. With us it is interesting as an erosion control plant and for forage. For centuries the wood has been used medicinally in Mexico. In the days of the Spanish Conquest it was shipped to Europe where it was high in favor. Those wishing an account of this tree are referred to Standley's "Trees and Shrubs of Mexico".

Coursetia microphylla is a tall shrub abundant in the foothills of the Santa Catalina and other southwestern ranges. While it is frequently found along washes and reaches its greatest growth there, it often forms almost pure stands on dry rocky slopes, especially those of north, northwest, or northeast exposure. While the stems and twigs are woody, the leaves and young twigs constitute a substantial browse and the seeds which are ripened through several weeks must be eaten by birds.

At times one finds bushes which are heavily infested with a lacquer insect. This lacquer has been used for perhaps ages in Sonora as a remedy for colds and fever, and even at the present time it can be purchased at some drug stores in southern Arizona. This lacquer is also used as a varnish and as such is comparable to other high grade lacquers. Apparently no attempt has ever been made to commercialize this product by propagating it. It is merely harvested where found sufficiently abundant. Careful studies of the insect, together with research on the best methods for propagating it so as to insure a crop, would seem well justified. The product is sold on the Mexican markets as Goma sonora and formerly brought about one peso per pound.

Robinia neo-mexicana, or New Mexico Locust, is by no means confined to New Mexico. It occurs in southern Colorado, in West Texas, throughout New Mexico and Arizona, and in Sonora, at high and medium altitudes. It is a very thorny small tree which resembles strikingly the common black locust. It forms dense thickets, sprouts freely from stumps and roots, and constitutes an excellent soil binder. The leaves, and especially the large bunches of pink flowers, are relished by all kinds of stock and unlike the black locust, they have no poisonous properties. The wood is very durable but commonly the trees do not attain sufficient size to make it valuable even for posts. This tree can be recommended for north slopes in the yellow pine region, or for lower elevations where there is a bit more moisture than commonly occurs on slopes and flats in our region.

Olneya tesota, the Ironwood, is confined to warm portions of the desert from southern Arizona to southern California and south into





Mexico and Lower California. The green leaves persist through the winter except during very cold winters, when the trees may suffer severely from freezing and all the leaves may be killed. In sections of very low rainfall as in the deserts south of Wellton, Arizona, large trees are abundant along the arroyos at the bases of the mountains and far out into the flats. The beans are good wildlife food, are eaten by stock, and were formerly used by the Indians. The wood is dark brown and very heavy. It is unsurpassed as fuel but very expensive of axes. The only way dead wood can be harvested satisfactorily in the desert is with a heavy sledge hammer as the wood is too hard for an axe but is brittle and can be quite easily broken. This tree will prove a failure in regions where oranges cannot be grown. If planted now our great grandchildren may enjoy their shade.

Benthamantha edwardsii was originally described as a Cracca, which suggests its relation to Tephrosia. In southern Arizona it is a low herb with woody base and tortuous horizontal roots. In Mexico and northern South America it becomes a shrub. In Sycamore Canyon, Santa Cruz County, Arizona, it forms a complete ground cover on dry flats in the canyon bottom. It seems to be heavily browsed but seems also to thrive under this abuse. Because of its relation to a very poisonous group of plants this species will be tested before it is tried in observational plantings outside the nursery.

Tephrosia. The Tephrosias are often called Craccas. Some species yield the rotenone of market, a very effective insecticide. Several species in Mexico and South America are used for stupefying fish. None of our southwestern species thus far examined has yielded rotenone in appreciable amounts. All of our Tephrosias have quite showy flowers in spikes, the leaves are pinnate without sessile glands, and the stamens are united by their filaments into one or two pieces or sets. Most of our species are perennial and have large woody roots. None seems to have much value for forage but most are good soil binders. Those observed grow in dry sites on rocky slopes or along rocky draws. Owing to the fact that the species have been poorly studied, only two will be discussed here.

\*Tephrosia tenella is confined in our range to the mountains of southern Arizona. It seems to be widely distributed in the Tropics in both hemispheres, however. This is a widely spreading perennial, somewhat woody at the base and with long tortuous thick, woody roots. It is readily recognized by its narrow leaflets and abundant spikes of pinkish red flowers. On the steep west slopes of the Baboquivari Mountains this is abundant, and is a good soil binder. There is evidence that it is browsed to some extent. It is thought in Mexico, however, to be poisonous to stock. While tests on the roots of this species showed no rotenone, it is possible it may have other poisonous substances since this is one of the species used in the Tropics to stupefy fish. The seeds are doubtless eaten by birds. It is not

\*According to Standley's Trees and Shrubs of Mexico this should be called Cracca purpurea.





suggested for erosion control or forage. As suggested above, it may prove to be a commercial drug plant.

Tephrosia leiocarpa is an erect suffrutescent plant with rather large flowers and heavy leaves, woody base, and thick woody root. Outside of Mexico it is found only in the mountains of southern Arizona. This species deserves study but cannot be recommended for erosion control until better understood.

There are two or three other rare species in southern Arizona which may be important as drug plants.

Oxytropis includes several of the true locos which cause severe losses in stock throughout the west. They are for the most part showy white or purple-flowered perennial herbs resembling milk vetches. The leaves are commonly sparsely to abundantly hairy. The plants are usually almost stemless, and the flowers are in dense spikes on rather long peduncles. Owing to the fact that these plants are rather unpalatable and are heavy seeders, they frequently become very abundant as a result of land abuse. In spite of the bad reputation of this genus as a whole, there are a few of the species which seem to be harmless. For example, O. besseyi of the plains country east of the Rockies, is authoritatively reported to be harmless. The genus as a whole, however, seems to offer very little that is promising for revegetation work on the ranges. O. saximontana, O. lamberti, and O. besseyi should be used as ornamentals in rock gardens and in borders.

Astragalus. Very little work has been done on our western milk vetches, the Astragali, in the nature of determining their value for forage or as soil builders. It was discovered many years ago that some of these plants were deadly to livestock and the term "loco" was applied to them and to similar plants belonging to the genus Oxytropis. Since that time more careful work has been carried out with the result that some of the milk vetches have been shown to be selenium lovers, being capable of taking up the inorganic selenium from the soil and converting it into organic selenium. In this condition the selenium not only is extremely poisonous to stock, but is capable of inoculating the soil on the death of the vetches or part of them, with a form of selenium readily taken up by other plants such as other legumes and grasses, rendering them in turn poisonous to stock. Selenium poisoning was formerly in many cases attributed to loco,- in fact this is not infrequently so at present. Several of the milk vetches, however, which are not selenium carriers are poisonous to stock due to alkaloids they carry. It is little wonder then that there has been a tendency to leave the milk vetches as a class, strictly alone. Many stockmen have realized, however, that certain of these plants are greedily eaten by stock and that no deleterious effects result.





The Nursery Section has undertaken to determine, with the aid of Professor O. A. Beath of the University of Wyoming, what milk vetches carry selenium in quantities sufficient to be toxic. It has not yet been proved that a species which carries selenium in one region, will be found to carry it wherever the plant grows. There is strong evidence to this effect, however. Apparently very many of the soils not commonly considered seleniferous, still contain sufficient quantities of the element to meet the requirements of the selenium-loving plants. For the above reason, we plan to eliminate all of the milk vetches from our program which have been shown to be seriously seleniferous in any locality.

It is equally important to eliminate the milk vetches which are known to be true locos. There seems to be no confusion here. If a plant is a true loco it is so, no matter where it grows. We may live to learn even here.

After eliminating the known seleniferous plants and the known locos, we still are faced with almost a bewildering number of species of milk vetches. Some of these must be tested before they can be given a clean bill of health. Others are quite definitely known to be good forage plants and worthy of trial in our revegetation programs. This may represent some pioneering, and in some cases careful tests must be made before definite recommendation can be made. The work on Astragalus rubyi in Montana should give us a hint of the possibilities.

Let us consider briefly a few of the Astragali which are known to be non-seleniferous, or practically so; where they were found; and which have not been openly accused of being locos. Before these plants, which are not seleniferous where collected, can be definitely passed for use, it may be necessary to try them in seleniferous soils and test the plants thus produced. This of course is unnecessary where the plants were collected in regions heavy in selenium.

Astragalus lonchocarpus is one of our most striking milk vetches because of the great amount of palatable leaf and stem it produces. The plant is perennial from a heavy tap root with a broad crown. An old plant produces dozens of erect leafy stems  $1\frac{1}{2}$ - $2\frac{1}{2}$  feet tall. The pods are abundant, long, and narrow, and have a distinct stipe or stalk holding the pod clear beyond the calyx lobes. In the foothills north and east of Santa Fe the plant is abundant. It may be found also in much of the mountain country along the Rio Grande north of Santa Fe. Since this plant is eaten without bad effect by sheep and since it generally is entirely non-seleniferous, it should be tried as a leguminous crop. Its root system does not make it superior for erosion control but the heavy thick crowns do. This plant may well be tried under cultivation. It may produce a heavy crop of palatable feed.



Astragalus tenellus is a low succulent appearing perennial herb with bright green leaves and slender stems from woody branched caudices. It is heavily browsed but seems to withstand grazing well. While this has not been observed to be abundant, its root system and palatable herbaceous top seem to warrant its trial in the nurseries. It is not seleniferous nor is it suspected of being a loco. It is found in the same range as A. lonchocarpus.

Astragalus alpinus is a milk vetch found at higher altitudes in Colorado and Wyoming. It has abundant prostrate or ascending slender stems from a woody caudex. The divided leaves have small leaflets and the flowers and pods are small. This is reported to be good forage and should be tried on the nursery at Albuquerque when seed can be obtained.

Astragalus humistratus has slender, prostrate or ascending leafy stems from a woody caudex. This caudex consists of a much branched crown which together with the prostrate or nearly prostrate habit of the plant, makes it a good soil binder. The plant has short racemes of small flowers which are yellowish white to purplish. We have made collections of it at Flagstaff, Heber, and Vermillion Cliffs in Arizona; and Tilden and Ruidoso in New Mexico. These places should give an idea of its range and altitude. While this plant looks very promising it should be tested carefully for alkaloids. It is not seleniferous.

Astragalus heliophilus is a handsome drought resistant perennial with spreading branched caudex and erect stems and leaves. Most of the leaves are basal but the stems are somewhat leafy at the upper branches. The leaves are 3-6 inches long and have about 15 pairs of glabrous, somewhat remote leaflets. This plant was observed in Cedar Mountains west of Grantsville, Utah, the summer of 1938. It doubtless has a wide range in central Utah. While this plant is not seleniferous, very careful tests must be made to determine its possible toxicity to stock before serious propagation can be undertaken. Its drought resistance and habit, however, recommend it.

Astragalus flexuosus must be considered on our questionable list. It is not seleniferous but may be a loco. Its habit and general appearance cause it to be confused with a milk vetch known to be a serious loco, Astragalus nothoxys. A. flexuosus will be grown in the nursery and material supplied to the Poisonous Plant Laboratory at Salina, Utah, for feeding tests. The prostrate ascending habit of the abundant slender stems make it an excellent ground cover and soil binder. It is locally reported to be good forage. It is not uncommon in the foothills of our southwestern ranges such as the Catalinas, Santa Ritas, and Huachuclas.

Astragalus diversifolius looks more like a narrow-leafed vetch





than like one of the milk vetches. It has very narrow ascending stems and long narrow leaves. It seems insignificant on the range and may prove valueless. It has drought resistance and a good root system to recommend it, and may be of value in heavy slick soils. It is not seleniferous and not suspected of being otherwise poisonous. Typical regions in which it grows are Price and Milford, Utah.

Astragalus calycosus. We should find legumes of extreme drought resistance even if these do not combine all the features of ground cover, root system, and forage. This species is abundant on very dry, rocky hills and flats about Seligman, Arizona. It has somewhat the habit of our common loco, Oxytropis, with heavy perennial taproot, divided crown, and erect basal leaves. The plants are practically stemless except for the flowering stalks. The leaflets are silvery canescent and the pods are short, curved and so deeply sulcate that they are two-celled. Should this plant prove non-toxic it may find a real place in our revegetation program.

Astragalus impensus. In the Cedar Breaks region of Utah and extending eastward in the lower yellow pine land, is a low creeping milk vetch with very short, sharp-pointed leaves. The entire plant sticks tightly to the ground and frequently forms a mat two feet or more across. Its abundance on certain overgrazed flats indicates that it takes advantage of these conditions adverse to good forage grasses. This seems to be valueless for forage but as a soil binder and soil builder it occupies a unique place. The altitude at which it normally grows will doubtless preclude its extensive use. It is, however, worthy of trial.

Astragalus nuttallianus has a wide range in the southwest. We have specimens collected at Shiprock, New Mexico; at Cedar Ridge, Coconino County, Arizona; and Sycamore Canyon, Santa Cruz County, Arizona. It has a prostrate habit, with several slender stems from a perennial root. The leaflets are small and somewhat silvery, the flower small and inconspicuous. The pods are small. There is real danger in confusing this with A. nothoxys, a very poisonous plant. The former, however, has short slender, scarcely erect peduncles, while the latter has rather stout ascending or erect peduncles, usually 3 inches or more in length. A. nuttallianus is reported to be excellent forage. The Nursery Section, however, will grow it in sufficient quantity to permit of a careful feeding test. It grows on dry rocky flats and in drier sites in canyon bottoms and valleys.

Astragalus bigelovii so strikingly resembles one of our common locos of the Rocky Mountains that it is often confused with it. It is practically stemless, has very woolly, erect leaves and peduncles, and large spikes of white to purplish flowers. Its range is probably confined to southern Arizona and New Mexico, extending into Mexico. Practically nothing is known of this plant but the Nursery Section is placing it on the suspected list. It is not seleniferous.





Astragalus amphioxys closely resembles the last discussed species. It is less woolly and grows at higher altitudes. It is one on the Nursery's list of highly questionable milk vetches, in spite of its freedom from selenium.

Astragalus utahensis has a wide range in Utah and extends as far north as Montana. A typical site for it is the sagebrush land of Cache Valley, Utah. It has distinct erosion control value, the large bunches of prostrate stems forming solid masses of soil, leaves, and stems often two feet or more across. The leaves are woolly and the pods, as Marcus E. Jones describes them, form pellets of wool. This species is not seleniferous and probably is safe for use. Discretion is the better part of valor, however, and it should be tested for alkaloids.

Astragalus pygmaeus, as the name indicates, is a dwarf plant. In habit and general appearance it resembles A. utahensis but it is a much smaller plant with less spread to the crown. Where it is sufficiently abundant it is a real factor in erosion control. This species is common in the open parks at Cedar Breaks, Utah, but Marcus E. Jones reports its range as the south slopes of the Uintah Mountains and eastward into Colorado. The relatively high altitude at which this thrives may preclude its use on the nurseries or in revegetation work. It has not been tested for alkaloids but there seems to be no reason for suspecting it of being poisonous.

Astragalus missouriensis, a milk vetch resembling A. utahensis but less spreading, has a very wide range in the Rocky Mountains from New Mexico to Montana and westward to Utah. It seems to have a good altitudinal range also. A typical site for it is the gravelly slopes below the yellow pine belt in the Colorado National Monument. While this is not reported to be a loco, careful feeding tests will be necessary before it can be recommended for range work.

Astragalus lotiflorus is a low, nearly stemless milk vetch which is abundant on rather heavy slick soil on the gentle slopes north of Price, Utah. The normal range of this species seems to be the east slope of the Rockies. The pods are thick and fleshy and the peduncle, which is usually twice as long as the leaves and prostrate, places the pods clear beyond the rosette of leaves. In the Price area this is suspected of being poisonous to stock. It is probable, however, that two other large species of milk vetches in this region are the guilty ones. Astragalus pattersoni and A. confertifolius are both abundant in this region and both are very dangerously seleniferous. No immediate work will be undertaken on this species because of its diminutive size.

Astragalus leucolobus is a low sprawling hairy annual with short inflated pods. It is extremely drought resistant and may have a





place in revegetation programs where a temporary soil builder is desired. Where observed in the Vermillion Cliffs region it was not abundant. This is not seleniferous and nothing is known of its alkaloid content.

Astragalus rusbyi is a deep rooted perennial with spreading caudex and slender prostrate or ascending stems, found at relatively high altitudes from northern Arizona in the Flagstaff region to the Sacramento Mountains in New Mexico, and southward into Mexico. It is a promising erosion control plant and probably is excellent forage.

Astragalus wingatanus was observed in the Colorado National Monument near Grand Junction in the juniper and pinon belt. It has a much branched perennial caudex and slender stems and leaves, - in fact it closely resembles a narrow-leaved ordinary vetch. This appears to be browsed and looks very promising. No feeding tests have been run.

There are many other milk vetches. The genus as a whole gives promise of yielding some very important plants to range work and agronomy. The fact that several species have been discussed does not mean that all will prove valuable in revegetation work. All those mentioned, however, seem worthy of trial. If one or two eventually prove to be of sufficient value to warrant growing them for seed production and use on the range or farm, much will have been accomplished.

Professor O. A. Beath has submitted the following lists of milk vetches as definitely to be avoided:

Astragalus confertifolius, A. haydenianus, A. oocalycis, A. pattersoni, A. praelongus, A. preussii arctus, and A. presuii latus, are all seleniferous, and wherever collected during the summer of 1938, contained selenium in dangerous quantities. Astragalus diphyus, A. lentiginosus, A. campestris, A. nothoxys, A. thurberi, and A. wootonii, are all definitely known to be serious locos because of the alkaloids they contain. When information extant is assembled there will almost certainly be others added to each of the above lists.

For the present it may be well to treat with suspicion all of the Astragali with large inflated pods, and certainly all those with a sickening seleniferous odor. This, however, is not a treatise on poisonous plants, but a group as important as the milk vetches should receive careful consideration. If plants are hardy, vigorous perennials which are browsed, they should not be dismissed until feeding tests have shown them to be dangerous.



Glycyrrhiza lepidota, licorice, is widely distributed in the west but cannot be spoken of as abundant. Experiments conducted many years ago indicated that the numerous large roots of this plant could be made a source of commercial licorice. It has not, however, been used for that purpose in this region. The plant can be readily distinguished by its rather coarse pinnate leaves with leaflets which taper to rather long points, and especially by the pods which resemble small cockleburrs. The plant requires considerable moisture and has no value for forage, which points strongly against its use. It, however, is a wonderful soil binder and may be a possibility as a commercial licorice crop in certain areas.

Psoralea. This genus contains a remarkable diversity of plants. Many of the exotics with which we are not concerned here are ornamentals of no mean value. Psoralea osculenta occurs in the eastern and southeastern portions of our range and is probably the only one of great significance. For an account of the uses of this plant refer to Bailey's "Standard Cyclopedia of Horticulture". It may be possible with the advance of soil conservation work, and especially hill culture work, that this plant may find a place in our program. It is a fair erosion control plant and grows in very dry rocky sites.

Psoralea micrantha is widely distributed throughout the southwest and is of economic importance because of its pernicious habit of occupying cultivated fields. It is the most common weed in the Flagstaff area, for example. It is a plant 6 inches to 1 foot high, arising from an extensive horizontal root system. The stems are erect, and the leaves, stems, flowers, and fruits are very glandular. It is a wonderful sand and soil binder, very effective especially on moving sand along highways. In cultivated fields it is removed with great difficulty and observations indicate that it is seldom, if ever, browsed. It is a positive evidence of land abuse. Because of the undesirable characteristics the nurseries are not planning on using this plant.

Psoralea tenuiflora is a much taller plant with naked stems and branched tops. It is readily distinguished from P. micrantha by its taller habits and its lack of root stalks, though it is easily confused with closely related species. This is probably the species so common from Pine and Payson, eastward through Pleasant Valley, in Arizona. It is also common in many parts of New Mexico. Judging by its absence in heavily grazed fields it constitutes a starvation diet for cattle and horses, though its abundance is an indication of former land abuse.

Parryella filifolia is a very glandular shrub with narrow pinnate leaves, small leaflets, narrow spikes of yellowish flowers, and very short indehiscent glandular pods. It has wandering horizontal roots which sprout freely. This species is abundant in many sandy





desert sites in northern New Mexico and northern Arizona. It is the plant extensively used by the Hopi Indians in making brooms and a decoction for repelling insects, particularly bed bugs. This plant is perfectly at home under cultivation at Tucson. When once established in good soil it is hard to eradicate. In cultivation at Shiprock, New Mexico, it becomes severely infested with a rust. This plant is recommended as a sand binder. It is valueless for forage or for wildlife. Tests in the Laboratory of Drugs and Related Plants in Washington, showed that it has too low a value as an insecticide plant to make it of commercial importance from that viewpoint.

Amorpha. The Amorphas are sometimes called False Indigos. They are low or tall shrubs, or even small trees, with long spikes of white or purple flowers and very glandular pinnate leaves and glandular flower clusters and pods. Some of them have a pungent unpleasant odor. They are unpalatable but are frequently used for windbreaks because of their dense habit of growth and the fact that they are not attacked by insects, especially grasshoppers. Formerly a type of Indigo was made from one or more species.

Amorpha occidentalis is our most common species. This has been confused with A. fruticosa, a closely related species. It is possible we have both species in our region. This is a tall shrub with long spikes of purple flowers and foliage with a disagreeable odor. It requires more moisture than can be supplied in most of our revegetation work. It may, however, find a limited use along valleys and washes. It is an excellent erosion control plant.

Amorpha fragrans. All our Amorphas have been imperfectly studied and their ranges are not certainly known. What we have called A. fragrans was collected west of the Huachuca Mountains. This is a fine shrub or perhaps it occasionally makes a small tree. It closely resembles A. occidentalis except that the fresh leaves are odorless but become pleasantly pungent on drying. It grows in much drier sites than those in which A. occidentalis commonly grows and may have a wider adaptability as a result.

Amorpha canescens is a dwarf Amorpha, rather rare in our range, occurring in the mountains of Colorado and northeastern New Mexico. It is widely distributed in the west central states from North Dakota to Louisiana. In the Soden-Baldy region the shrub appears to be browsed quite heavily. It can be distinguished from other Amorphas by white hairiness of the entire plant, by the small leaflets, the compact habit, the bright blue flowers, and the lack of unpleasant odor. This plant should be tried at relatively high altitudes.

Amorpha californica probably occurs in our range. For all practical purposes, however, it may be considered with A. occidentalis.





Dalea (Parosela). Many of us have learned to know these as Paroselas but the mandates of the National Herbarium and the International Code say we must use the name Dalea. This is very unfortunate because of the confusion with the showy garden flower, Dahlia, a very different plant. Dalea should be pronounced with a long "a". Dahlia's preferred pronunciation is with a broad "a" as in dawn. Perhaps the more common pronunciation is with a short "a" as in cat.

Probably no other genus of plants can be spoken of as more characteristic of the southwest than this. Dalea scoparia covers thousands of acres of sandhills and waste slopes, and is frequently spoken of as purple sage, particularly when the bushes are solid masses of blossoms. Several other Daleas are shrubs even more beautiful, though much less abundant. We have one species that is frequently a tree and several which are inconspicuous annuals.

How may we know the Daleas? 1st - They have pea-like flowers; 2nd - They almost always have leaves and fruits covered with glands which give the plants a distinct odor; 3rd - The parts of the calyx are united and there are five lobes which are usually narrow or almost bristle-like; 4th - There are 9 or 10 stamens all united by their filaments; 5th - Pods are small, glandular, and included in the calyx.

The following are some of the more important Daleas in the southwest. Some are already in use as ornamentals:

Dalea spinosa is known in the Mojave Desert as Smoke Tree or Indigo Bush. Through much of the year it is practically leafless, a mass of grayish thorns, but when in blossom it is a mass of dark blue, one of the most spectacular plants on the desert. Even when leafless the mass of gray stems and spines resemble wisps of smoke along the desert arroyos. This small tree is worthy of extensive use as an ornamental in very dry hot regions along highways, and in desert landscapes. It has little erosion control value and is not browsed.

Dalea emoryi is a curious, quite showy shrub confined in our range to the Mojave and Colorado Deserts. Unlike the Smoke Tree, it grows on the dry mesas and ridges, whereas the Smoke Tree confines itself to the rocky arroyos. It is one of our most glandular shrubs, the stems, leaves, and flowers being a mass of oil or resin glands. The plant was formerly used by the Indians for making a dye and investigation of its properties may prove that oils or dyes of commercial value can be derived from it. Many of the bushes east of Yuma are parasitized by a flowering plant, which is one of the smallest in existence. About all there is to a single plant is the blossom or fruit and this is the size of a pin head. The Dalea stems, however, are often heavily laden with these parasites. Curiously enough this parasite, a Pilostyles, is related to a plant in Java and Sumatra which has the largest flower of any plant in the





world, it being 2 - 3 feet across. This is the *Rafflesia*. *D. emoryi* is suitable for ornamental plantings where curious, rather than particularly handsome plants are desired. It has no forage value and is not browsed. As mentioned above, however, it may contain oils, resins, or dyes which will become significant in medicine, the arts, or sciences.

*Dalea scoparia* was mentioned above. Where it is found the soil is usually in a state of flux. Sand dunes are shifting from place to place and many assume that this shrub is a good sand binder. It is very abundant along the foothills out from the Rio Grande Valley and along the sandy bottoms about Deming. As it commonly grows it has little value in preventing sand blowing. In fact it may aggravate a bad situation as the bushes grow in bunches and the winds are forced into troughs. In soil conservation practice, however, these bushes could be planted in staggered dense rows and should prove very effective in preventing sand movement. *D. scoparia* in abundance is an indication of overgrazing or land abuse. It is valueless as forage. This species is easily grown and is an attractive ornamental.

*Dalea formosa* is a low, much branched shrub common in the foothills of many of the mountains of Arizona and New Mexico, and extending into southern Colorado. In time of blossoming it attracts the traveller as he passes along the highway through the hills directly west of Albuquerque, and again in the first hills between Bernalillo and Santa Fe. This shrub has a delicacy about it when in bloom comparable to that of the lady friend at a dress ball. The finely divided leaves and purple flowers carry a pleasing aroma.

It is stated frequently that a pure grass range is not a good stock range. Browse shrubs are necessary. This little bush is par excellence on many of our foothill ranges as it supplies browse at seasons when the grass is of little value. Besides this the plants are easily cultivated, are drought resistant, and make handsome ornamentals in yards and along highways. Unfortunately the seed is small and difficult to collect.

*Dalea greggii* is very much like *D. formosa*, not quite so delicate, and not so intricately branched. The much more hairy flowers and leaves distinguish it. Most folks, however, confuse the two until the differences are noted. This is somewhat more southern and western in its distribution, being common in the foothills of the Graham and other ranges of southern Arizona. While this species is a bit less attractive than *D. formosa*, it is still a shrub worthy to grace the yards of princes and paupers. It is excellent browse, a good erosion control plant, drought resistant, easily propagated, and an excellent seed producer. Pray, what more do you want?





Dalea sanctae-crucis is a shrub not readily distinguished from D. greggii. It is, however, much more densely hairy and is confined in our range to extreme southern Arizona though it extends far down into Chihuahua and Sonora. This species is abundant on some of the ridges south of Ruby, Arizona. In forage value, in erosion control value, and as an ornamental it is comparable to D. formosa and D. greggii.

Dalea frutescens is another of the D. formosa type, -one of the most handsome. It is readily distinguished by its smooth instead of hairy calyx. Its flowers also are lighter, shading toward a pink. This is one of the dominant shrubs in parts of the Capitan and Sacramento Mountains. Less investigation has been carried on with it than with the other Daleas last mentioned. It is similar in forage and erosion control value, and should prove to be an easily propagated ornamental.

Dalea sp. Perhaps you wish a lot of these Daleas could be lumped together and less said about them. Well, it can't easily be done. While they look somewhat alike, they just naturally are very different and it is likely they will function differently in our program. One of the most striking of our Daleas grows in the foothills of the Guadalupe Mountains. It is a prolific bloomer and the bushes are a mass of light cherry colored blossoms for six weeks or more after the summer rains begin. The bushes are very low and compact, possibly due to grazing, and constitute wonderful erosion control plants. Some day it may carry a new name or maybe we shall find that it is the same as some bush growing in Mexico. For the present we may call it the Guadalupe Dalea. Perhaps next year we can tell more about its propagation.

Dalea sp. Santa Cruz County, Arizona, has yielded some of our most unusual plants. Plants commonly found in southern and eastern Texas or even Florida and Virginia, are hidden away in the rough country west of Nogales. Here we find the Spanish moss common in the timbered region of the south. And here we also find several of our Daleas, some of which are not found generally elsewhere. One from this region similar to D. formosa, has been propagated in the nursery at Tucson. It is distinguished by its much longer, pinnately divided leaves and distinctly different calyx. This must take its place among our promising forage and erosion plants. It is a handsome drought resistant ornamental as well.

We should think of the last six shrubs, i.e., Dalea formosa, D. greggii, D. frutescens, D. sanctae-crucis, and the two unnamed ones, as constituting one group quite different from other Daleas of our region. The following species constitute another group:

Dalea johnsoni when it is in blossom is one of the most handsome shrubs of the desert. By desert here is not meant the foothills





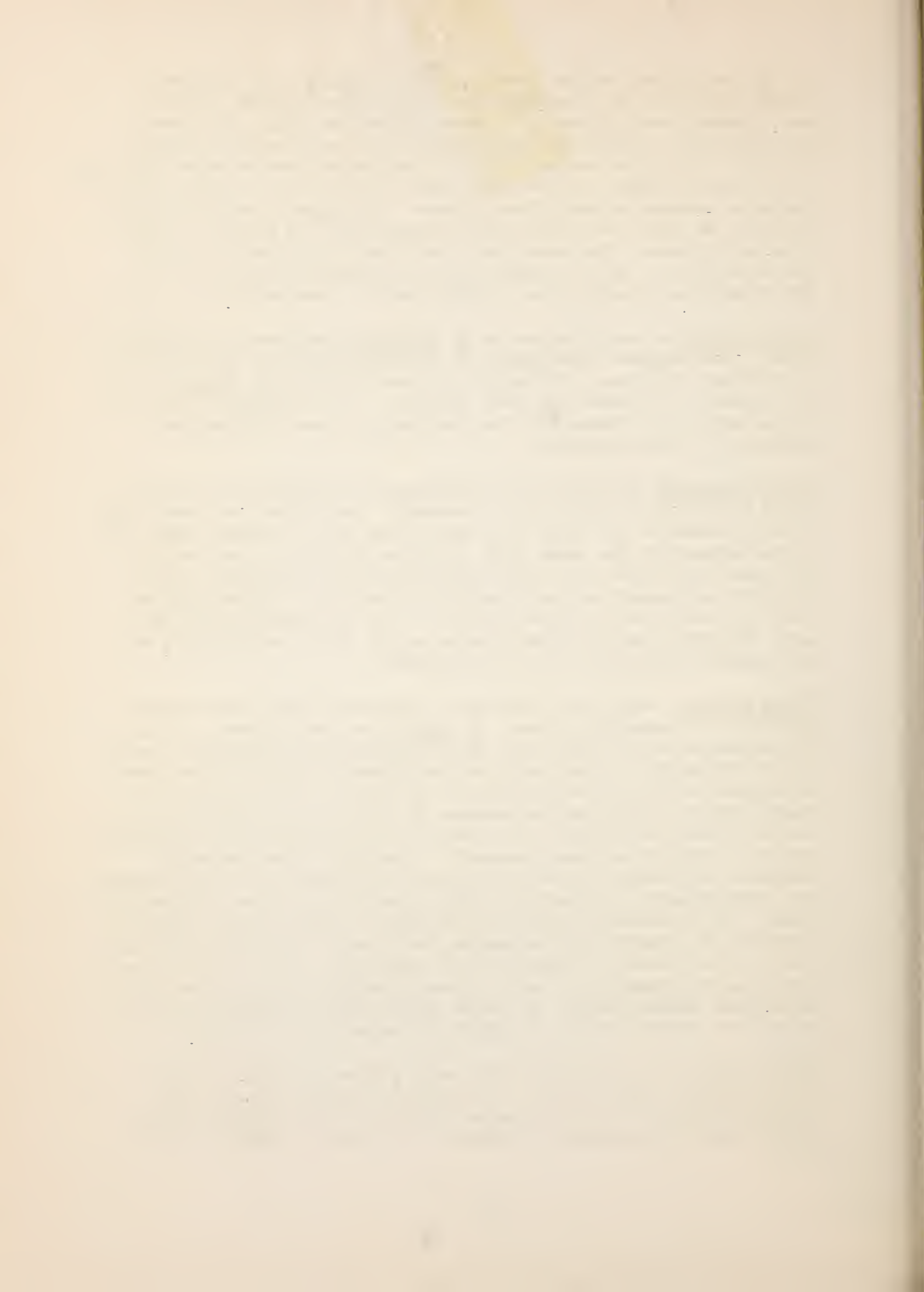
of the Catalinas, or the Grahams, or the Sandias, but the much drier regions of southwestern Utah and adjacent Nevada and Arizona. During much of the year these bushes are naked of leaves and blossoms, the twisted and gnarled stems and branches appearing dead. With the coming of rains the bushes become rather sparingly but consistently clothed with leaves with slender pinnae, and gorgeous racemes of dark blue flowers. The plants produce abundant seed but we know too little about propagating the plants to make recommendations. The bushes have very long tortuous roots with few side roots. It is a rather poor soil binder and of no value for forage but should prove a highly prized ornamental.

Dalea amoena is very similar to D. johnsoni and grows in similar sites. Its maximum development is in the Vermillion Cliffs section of northern Arizona. The bushes are smaller than D. johnsoni and the racemes of flowers are much shorter. It is worthy of consideration only as an ornamental for planting in desert landscapes, gardens, or along highways.

Dalea enneandra can hardly be recognized as belonging to the same group of plants as those just discussed. The bushes are erect and almost broom-like in habit with many stems to the clump. Each pod is surrounded by the dense tuft of hairs attached to the calyx. The stems and leaves are bright green and very glandular. This shrub is not common to but a small portion of our ranges but occurs in extreme eastern New Mexico. It is not browsed, but may have distinct erosion control value on dry rocky broken land, and may contain essential oils of importance.

Dalea mollis. Among our herbaceous perennial Daleas are several prostrate or ascending forms. D. mollis is one of these. It is not uncommon in very dry sites about Florence and doubtless occurs far to the west. A specimen from the Pinacate Plateau of extreme southwestern Arizona was doubtfully referred to this species. The plant smells to high heaven because of oil in the glands of the leaves, stems and fruits. The glands of this species are possibly unique. They are at least unusual. Along the stems below the clusters of flowers and extending also up through the inflorescence, are flask-shaped or top-shaped dark glands with slender projecting necks. On examination these can be made to exude first a minute quantity of a purple dye substance, and then a minute drop of clear amber colored oil. It does not take any great stretch of the imagination to conceive of such a plant producing oils or dyes of some importance commercially. It grows sufficiently abundant to be of value for erosion control though it is valueless as forage.

Dalea lanata is a prostrate, very hairy, glandular herb of the eastern part of New Mexico. It lacks the curious glands of D. mollis but due to its much longer prostrate stems it is a better soil binder. It probably, however, is a plant of slight significance.





Dalea pogonanthera is abundant in the foothills of some of our southwestern ranges. It has a heavy taproot and a broad caudex. The stems and leaves are erect, the plant thus being relatively low in erosion control value except where very abundant. In spite of its glandular character it is quite heavily browsed and the spikes of yellow flowers give way to good seed crops. It should be tried on range revegetation work on sites similar to those on which it is normally found growing.

Dalea nana is an erect herb or slightly shrubby plant resembling D. pogonanthera but less strict in habit. Like it, this has silvery, hairy leaves and yellow flowers. The spikes of flowers, however, are much shorter. It is probably fair browse and adapted to dry rocky sites at comparatively low altitudes throughout our range.

Dalea wrightii is somewhat similar to D. pogonanthera but the leaflets are much larger and the habit more nearly prostrate, making it better for erosion control. It is doubtless browsed. Its range is southern New Mexico and western Texas.

Dalea spp. Two quite important browse plants occur in extreme southern Arizona, which are quite frequently overlooked because of their diminutive size. They really must be classed as low shrubs though they are not commonly a foot high. In the nursery at Tucson they retain their abundant, finely divided leaves all winter. The flowers occur in dense heads or short spikes on rather long peduncles. They are, however, not conspicuous. One species is almost smooth, having very little hair on the leaves and stems, while the other is quite hairy. They both occur in sufficient abundance to be significant in erosion control and as browse on dry slopes and washes. These Daleas can be readily recognized by the very pleasant lemon-like odor of the leaves when they are crushed. This is so pronounced as to suggest the use of the plants for the extraction of essential oils.

Dalea parryi is not uncommon in the foothills of the mountain ranges of southern Arizona. It frequently occurs in sufficient abundance to constitute a fair ground cover. This is a widely branched herb or low bush with rather small scattered divided leaves and slender spikes of blue flowers. In the nursery at Tucson it produces an abundance of seed and escapes freely. It has distinct erosion control and ornamental value, but does not appear to be palatable.

There are several other Daleas in the southwest, some of them annuals, but it is hoped that the more important ones have been discussed here. If a prediction may be indulged in it is that some of these plants will eventually be propagated for their essential oils or resins.





Petalostemon. The Petalostemons, sometimes called Prairie Clovers, are closely related to the Daleas. Instead of having 9 or 10 stamens they have five. The flowers commonly occur in even denser spikes or heads and are often very showy and suited for use as ornamentals. The stems are quite wiry and constitute poor browse.

Petalostemon oligophyllus is a smooth white flowered perennial, exceedingly common in the Rio Grande Valley and doubtless elsewhere in its range, extending from South Dakota to Mexico and Nebraska to central Arizona. This is poor forage, a fair erosion control plant, and ground cover, and may be an important wildlife plant because of the abundance of seeds it produces.

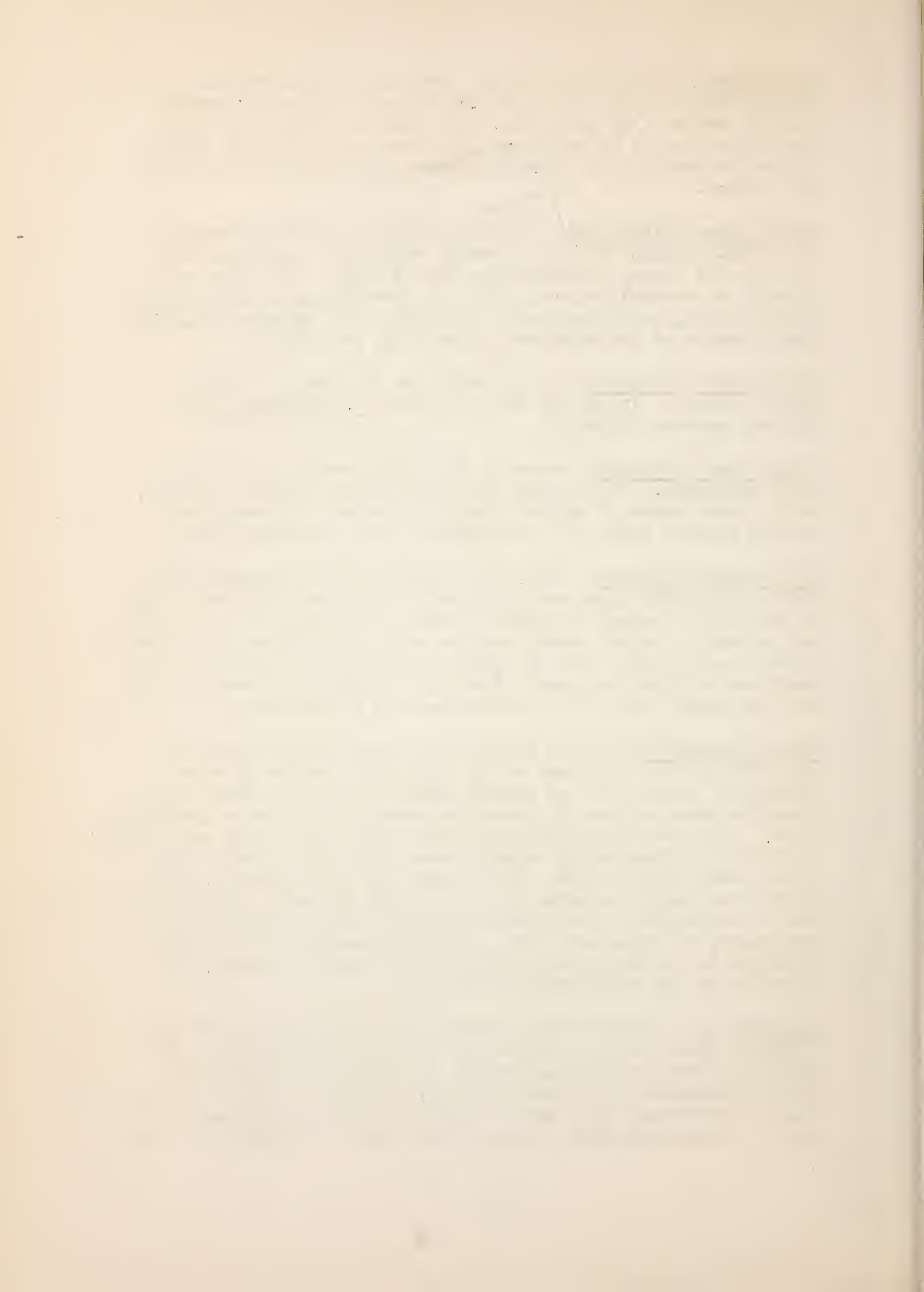
Petalostemon flavescens is so similar to the last as to need little comment. It may be said to replace P. oligophyllus in Utah and western Colorado.

Petalostemon purpureus occurs in the plains states east of the Rocky Mountains. It is among our most handsome prairie clovers, having dense heads of delicate purple flowers. In forage and erosion control value it is similar to those mentioned above.

Petalostemon villosus. This, or a closely related species, was observed on rocky limestone hills east of Douglas, Arizona. Here it had white, instead of purple flowers. The stems are ascending from a woody, divided crown, and the very abundant leaves are densely white and hairy. Here it appears to be browsed to some extent, doubtless by sheep or goats. From the standpoint of erosion control and forage this is our most promising Petalostemon.

Nissolia schottii has been planted at several points along the east side of the lath house on the Soil Conservation Service nursery at Tucson. It has rather tender woody stems which withstand the usual winter at Tucson but occasionally freeze back even there. The roots, even after the tops freeze back, send up a vigorous growth of stems which quickly cover brush and arbors. The leaves form a dense shade. The flowers are inconspicuous. The fruits when mature resemble those of an ash or maple. This vine can be recommended as an ornamental along highways where it has opportunity to climb over rocks, brush or posts. It is drought resistant but probably only suited to its natural habitat, the foothills of the southwestern ranges.

Hedysarum sp. Our wild Sulla clovers have not been studied with a view to using them in agronomy or in range revegetation. The discussion here is based on but one collected in the Colorado National Monument near Grand Junction, Colorado. This is a perennial, herbaceous plant with a divided or sprawling caudex, and erect or ascending stems about one foot high. It has dense spikes





of pinkish purple flowers and pods made up of rather large loment or divisions. This looks so promising as a leguminous crop or pasture plant that it is being tried on the nurseries at both Albuquerque and Tucson. Others of the Rocky Mountain Sullas will be observed and collected in the future.

Aeschynomene americana. This specific name is almost certainly wrong but it should prove a guide to those who wish to look up the plant. It has been found in but one place in the southwest, i.e., in Sycamore Canyon, Arizona, that great museum of unusual southwestern plants. The pods of the Aeschynomene resemble those of the Desmodium. They are made up of joints or loment but the leaves are delicate, pinnate, and sensitive to the touch. The plants are erect, branchy, annual 1-2 feet high, frequently abundant enough to make a complete ground cover. If any annual among our peas should be worth cultivating as a soil builder, it should be this one. The roots are masses of bacterial nodules.

Desmodium. The Desmodiums are known by many as Meibomias and by others as Tick Trefoil or tick seeds. They are related to the Lespedezas, so well known in the east and south as cover and green manure crops. Some of the Desmodiums are used in Mexico and elsewhere very much as the Lespedezas are with us. The discussion of the following species may convince some that these plants may well be used in the southwest as substitutes for the Lespedezas. The lomented pods are characteristic of this and one other genus in the southwest.

Desmodium cinerascens is a tall, rather coarse perennial with woody base, hairy trifoliolate leaves, and spikes of pink flowers. The roots are large and the crown heavy. In its native haunts it is confined to rough, hilly or mountainous country of southern New Mexico, southern Arizona, and Mexico. It responds beautifully to cultivation, making large plants with a great abundance of seeds. In habit it closely resembles Lespedeza bicolor. In Santa Cruz County, Arizona, it is sufficiently abundant to be a real factor in erosion control. Its palatability is probably low due to the woody character of the stems. It is recommended for rocky sites in the pinon and oak regions, and for trial as cover crop under cultivation.

Desmodium batocaulis is a trailer producing an abundance of long, slender stems and leaves. On the nursery at Tucson it produces a dense thick ground cover and an abundance of seed. This species was found in the Animas Mountains, New Mexico, and in Santa Cruz County, Arizona, indicating a wide distribution in our southern ranges. This is probably good forage and seems to offer a real possibility as a cover crop. It is doubtful that it will withstand heavy grazing.

Desmodium grahami has been observed only in the Prescott region





though its range is doubtless throughout the mountainous regions of central Arizona and New Mexico. It is one of our most striking tick seeds, having rather coarse rhombic leaflets and pods made up of large divisions or loments. It is a trailer producing an abundance of stems 2 feet or more long and abundant leaves. Its palatability is not known but probably is high. This species responds readily to cultivation and is recommended as a cover crop. While withstanding considerable drought it doubtless will not stand up under heavy grazing.

Desmodium angustifolium var. gramineum is probably a relatively rare plant. It has been observed in Santa Cruz County, Arizona, and doubtless occurs in most of the southern Arizona ranges. This Desmodium is peculiar in having a single leaflet to the leaf. The leaflet is 2 or 3 inches long and very narrow. This has not been found in sufficient quantity to judge its erosion control value or its palatability. The type of plant, however, indicates that both are high. Further study in the nursery is necessary before suggestions can be made for the use of this species.

Desmodium sp. An undetermined species of promise was collected in a deep canyon northeast of Globe on Highway 60. This is an erect plant with abundant stems and leaves, herbaceous except at the very base. The leaflets are peculiar in that those on the lower part of the plant are oblong to oval, while the upper ones are almost linear. This species is not likely to withstand severe drouth or heavy grazing. It looks like a promising cover crop.

Desmodium sp. In the canyons in Santa Cruz County, Arizona, and in the Baboquivari Mountains in Pima County, is a Desmodium with simple leaves (not trifoliate as most of the Desmodiums), rather wiry woody stems and rhizomatous roots. In dry canyons and draws it is a most effective soil binder, forming as it does a complete ground cover and filling the soil with long tangled roots. The plants as a whole must be low in palatability due to the woody stems. This species is doing well in the nursery at Tucson.

Desmodium sp. A species which is abundant on some of the rocky south-facing slopes and ridges in Santa Cruz County, Arizona, is an undetermined species. It has a habit immediately between the erect forms like D. cinerascens and those trailers like D. batocaulis. It forms an excellent ground cover, the stems and branches being ascending and the leaves quite viscid. It is drought resistant and seems to withstand some grazing. From the standpoint of density of ground cover this is one of our most promising Desmodiums.

Desmodium bigelovii. We are often biased in considering annuals, as an annual does not constitute year-round protection to the soil. A leguminous plant, however, that adds nitrogen to the soil and





furnishes something in the form of green manure, may well be worthwhile as a soil builder. This Desmodium is a weed which comes in abundantly on waste or overgrazed land in the bottoms of draws and canyons in New Mexico and Arizona. The individual plants are usually quite slender but they make a complete ground cover. This may prove a boon where a leguminous nurse crop is called for. Under cultivation also, it may be comparable to Crotalaria.

Desmodium rosei (unpublished), is another promising annual Desmodium from the Animas region in New Mexico. It is similar to the last mentioned species and grows in similar sites. It seems worthy of a trial on the nursery at Tucson.

Desmodium neo-mexicana was observed in the Black Range of New Mexico on waste lands. It is similar in habit and probably possibilities, to D. bigelovii.

Vicia. The vetches are hardly to be considered as erosion control plants under normal or heavy grazing. Frequently they make a complete ground cover in isolated spots where stock are unable to get. All of our native ones are probably highly palatable and much better adapted to agronomy than to range work.

Vicia americana is our best known native vetch. It is common throughout the Rocky Mountains at comparatively high altitudes, usually on semi-shaded or shaded moist slopes. It is a trailer or twinor with oblong leaflets and heads of rather large, blue flowers. This species withstands grazing better than many others and is considered a valuable forage plant. Its altitudinal range and moisture requirements preclude its use in Soil Conservation work in Region 8.

Vicia pulchella is probably confined in Arizona and New Mexico to relatively high altitudes. The traveller over the Black Range between Santa Rosa and Hillsboro will observe it in abundance in the bar pits on the east slopes of the mountains. It is also common in the vicinity of Magdalena. The long stems are very numerous from a stout perennial root and frequently form so thick a mass on the ground that the underside becomes heavily mildewed. The leaves are small, grayish, and the leaflets slender. The flowers are pale blue, in dense short spikes. The short flat pods are produced in abundance. This vetch deserves careful consideration as a cover crop, as green manure, or as a possible hay crop. It is more drought resistant than V. americana and grows in more exposed places.

Vicia melilotoides is generally confused with V. pulchella. Wootton & Standley in the Flora of New Mexico, emphasize the differences between these vetches, and these differences seem clear cut and constant. This species has dense short spikes of white flowers. Vicia melilotoides seems to have a more limited range than V. pulchella, though this may not be true. It seems to extend to somewhat lower altitudes. Along the Blue River and its tributaries, of eastern





Arizona, the plant is abundant. Frequently it climbs low bushes or dead brush, forming a compact and tangled mass 2-3 feet high. This vetch is comparable to V. pulchella and should be tried for the same purposes. A specimen collected at Engineer Springs, Arizona, and tentatively called V. melilotoides, may be a different species.

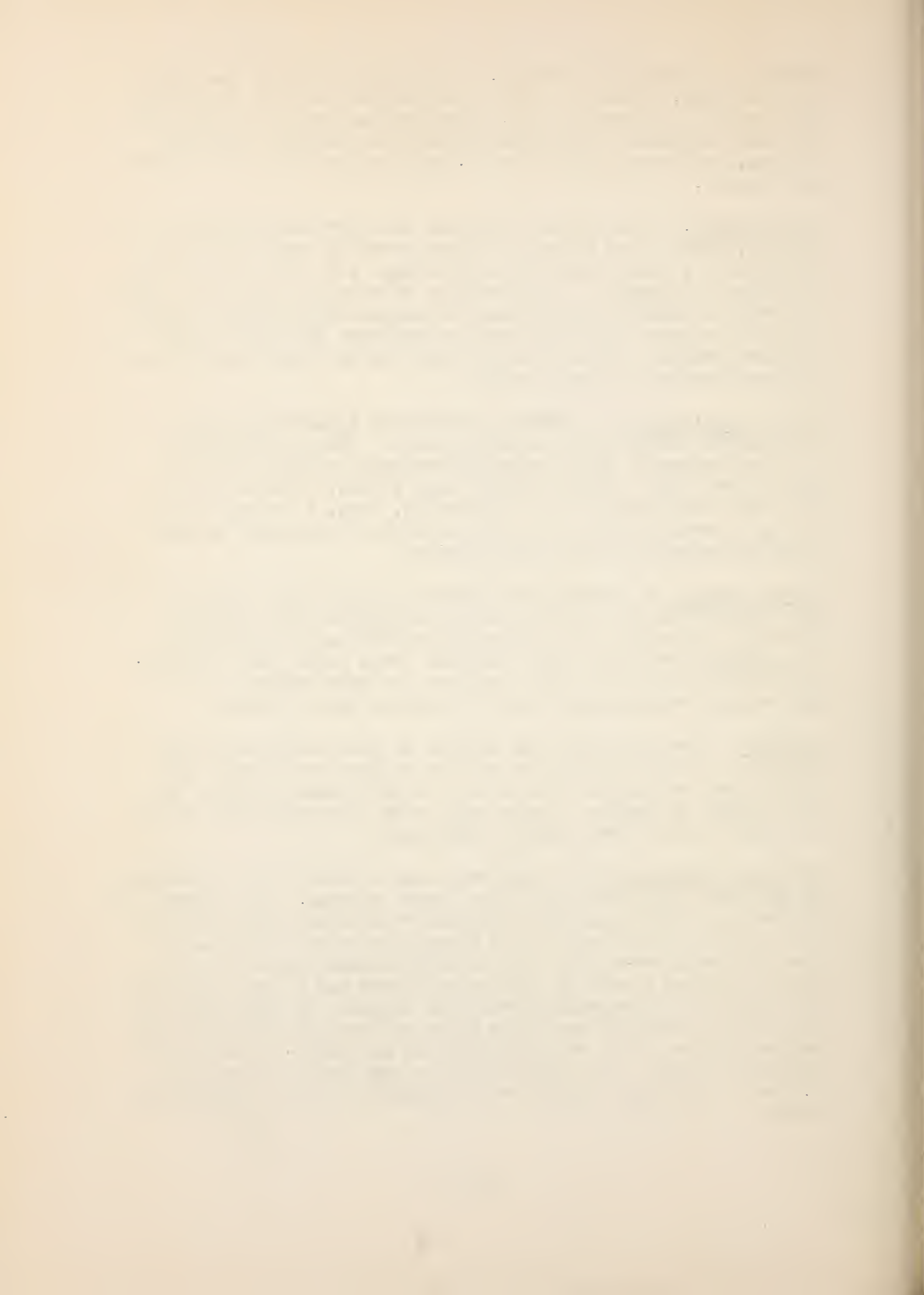
Vicia exigua. This species resembles the last two discussed. It, however, seems to be an annual. The amount of stems and leaves produced by a single plant is surprising. Like the others, it is a trailer or climber. It has whitish flowers and short flat pods. It grows at rather low altitudes in canyons and sheltered spots along dry washes in the mountains of southern New Mexico and southern Arizona. This vetch may prove to be a good quick crop. It seems worthy of careful trial.

Vicia sparsiflora is an annual? trailer or climber with very long narrow leaflets and wandering roots. This is apparently a rather uncommon, though widely distributed species found in Arizona and Utah. Where observed near Alpine, Arizona, and in the Cedar Mountains west of Grantsville, Utah, it seemed promising as a forage plant. It seems doubtful if the plant in the Cedar Mountains is really this species.

Vicia linearis is probably not uncommon in Colorado. Plants were observed in the bar pits along the highway from Dillon to Kremmling, Colorado. It is a very prolific annual resembling V. pulchella but with larger flowers. This looks like a promising annual vetch for a cover crop and for green manure. It is not drought resistant but does not require high altitudes.

Lathyrus. There are not many species of wild sweet pea in the southwest. One of these, however, is an important forage and erosion control plant. Out of about a half dozen species, two seem worthy of mention. Others may, with observation and study, be found to be of even greater importance.

Lathyrus decaphyllus is a handsome large flowered vine resembling in many ways the sweet pea of the flower gardens. It, however, is a perennial with masses of horizontal roots which sprout freely, with rather narrow leaflets and flowers about half the size of the commercial sweet pea. In northeastern New Mexico this frequently becomes a weed in cultivated fields and in bar pits along the highways it frequently forms pure stands. In many places in the lower yellow pine and pinon belts of Colorado, Utah, Arizona, and New Mexico, it is very effective at the heads of gullies in checking cutting. Its palatability is relatively low but it is browsed. This plant should not be neglected in our revegetation work.



Lathyrus graminifolius is another perennial wild sweet pea. It may be considered rather rare. This, however, has an excellent root system and vigorous leafy top, with long slender leaves. Its range in southern New Mexico and Arizona indicates that it will withstand more drought than L. decaphyllus, though otherwise it appears to be inferior to it.





# INDEX TO NAMES

Acacia	8	Astragalus (Cont.)	
constricta paucispina	8,9	tenellus	28
cuspidata	9	thurberi	31
farnesiana	8	utahensis	30
greggii	8	wootonii	31
lemmoni	9	wingatanus	31
millifolia	9		
shrevei	9	Bastard Mesquite	7
sp.	9	Beans	21
suffrutescens	9	Benthamantha edwardsii	25
Acuan	10	Bird's-foot Trefoil	18
Aeschynomene americana	40	Butterfly Pea	20
Amorpha	33		
californica	33,34	Calliandra	7
canescens	33	eriphylla	7
fragrans	33	humilis	7
fruticosa	33	reticulata	7
occidentalis	33	schottii	7
Astragalus	26-31	Cassia	13
alpinus	28	bauhinioides	14
amphioxys	30	covesii	14
bigelovii	29	leptocarpa	14
calycosus	29	lindheimeriana	14
campestris	31	roemeriana	14
confertifolius	30	wislizeni	13,14
diphysus	31	Catclaw	8,11
diversifolius	28,29	Cercidium torreyanum	12
flexuosus	28	Cercis occidentalis	12
haydenianus	31	Chamaecrista	
heliophilus	28	leptadaemia	14,15
humistratus	28	nictitans	14
impensus	29	wrightii	15
lentiginosus	31	Clitoria mariana	20,21
leucolobus	30,31	Clover	17
lonchocarpus	27	California Deer	18
lotiflorus	30	Coursetia microphylla	24
missouriensis	30	Cracca	25
nothoxys	28,31	Crotalaria lupulina	17
nuttallianus	29		
oocalycis	31	Dalea	34-38
pattersoni	30,31	amoena	37
praelongus	31	emoryi	34,35
preusii arctus	31	enneandra	37
"    latus	31	formosa	35,36
pygmaeus	30	frutescens	36
rubyi	27	greggii	35
rusbyi	31	johnsoni	36,37

Name		Age		Sex		Profession		Religion		Marital Status		Children		Notes	
John Smith		35		Male		Farmer		Protestant		Married		3		Lives on Main St.	
Mary Jones		28		Female		Homemaker		Catholic		Married		2		Lives on Oak St.	
Robert Brown		42		Male		Teacher		Protestant		Married		4		Lives on Elm St.	
Elizabeth White		30		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Wilson		25		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Davis		22		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Miller		38		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna Taylor		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Clark		40		Male		Farmer		Protestant		Married		4		Lives on Willow St.	
Charlotte Adams		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Baker		32		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Green		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard King		45		Male		Teacher		Protestant		Married		5		Lives on Sycamore St.	
Elizabeth Hill		29		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Scott		33		Male		Farmer		Protestant		Married		3		Lives on Chestnut St.	
Mary Young		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Lee		41		Male		Teacher		Protestant		Married		4		Lives on Oak St.	
Elizabeth Hall		31		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		28		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		36		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse		Protestant		Married		1		Lives on Pine St.	
James Allen		29		Male		Student		Protestant		Single		0		Lives on Maple St.	
Sarah Evans		23		Female		Teacher		Protestant		Single		0		Lives on Birch St.	
Thomas Wright		35		Male		Blacksmith		Protestant		Married		2		Lives on Cedar St.	
Anna King		26		Female		Homemaker		Catholic		Married		3		Lives on Spruce St.	
George Hill		43		Male		Farmer		Protestant		Married		5		Lives on Willow St.	
Charlotte Scott		24		Female		Teacher		Protestant		Single		0		Lives on Ash St.	
William Green		34		Male		Blacksmith		Protestant		Married		2		Lives on Hickory St.	
Margaret Adams		27		Female		Homemaker		Catholic		Married		3		Lives on Poplar St.	
Richard Baker		46		Male		Teacher		Protestant		Married		6		Lives on Sycamore St.	
Elizabeth Clark		30		Female		Nurse		Protestant		Married		1		Lives on Walnut St.	
John Evans		37		Male		Farmer		Protestant		Married		4		Lives on Chestnut St.	
Mary King		25		Female		Homemaker		Catholic		Married		2		Lives on Elm St.	
Robert Hill		44		Male		Teacher		Protestant		Married		5		Lives on Oak St.	
Elizabeth Scott		32		Female		Nurse									

Dalea (Cont.)		Krameria	15
lanata	37	glandulosa	15
mollis	37	grayi	16
nana	38	secundiflora	15
parryi	38		
pogonanthera	38	Lacquer	24
sanctae-crucis	36	Lathyrus	43
scoparia	35	decaphyllus	43
sp.	36	graminifolius	44
spinosa	34	Licorice	32
spp.	38	Loco	26
wrightii	38	Locust	24
Desmanthus	10	Lotus	18
cooleyi	10	alamosanus	19
illinoensis	10	argyraeus	19,20
jamesii	10	corniculatus	18
virgatus	11	greenei	19
Desmodium	40	hamatus	20
angustifolium var.		humistratus	20
gramineum	41	longibracteatus	19
batocaulis	40	rigidus	18,19
bigelovii	41,42	scoparius	18
cinerascens	40	wrightii	19
grahami	40,41	Lupine	17
neo-mexicana	42	Lupinus	17
rosei	42	Lysiloma thornberi	8
sp.	41		
Erythrina		Mesquite	9,10
flabelliformis	20	Milk Vetches	26-31
Eysenhardtia		Mimosa biuncifera	11
orthocarpa	23,24	dysocarpa	11
		lemmoni	11
Fairy Duster	7	Morongia occidentalis	10
False Indigo	33		
		New Mexico Locust	24
Galactia wrightii	21		
Glycyrrhiza lepidota	32	Olneya tesota	24,25
Guadalupe Dalea	36	Oxytropis	26
Hedysarum sp.	39,40	besseyi	26
Hoffmanzeggia		lamberti	26
densiflora	13	saximontana	26
jamesii	13		
microphylla	13	Palo dulce	23
sp.	13	Palo verde	12
Hog Potato	13	Parkinsonia	
		aculeata	12
Indian Bean	20	microphylla	12
Indigo Bush	34	Parosela	34
Indigofera spaherocarpa	23	Parryella	
Ironwood	24,25	filifolia	32,33
		Partridge Pea	14





Petalostemon	39	Vetches	42
flavescens	39	Vicia	42
oligophyllus	39	americana	42
purpureus	39	exigua	43
schottii	39	linearis	43
villosus	39	melilotoides	42
Peteria scoparia	23	pulchella	42
Phaseolus	21	sparsiflora	43
acutifolius	23		
angustifolius	22	Wild Sweet Pea	44
angustissimus	22		
dilatatus	22		
macropoides	22		
metcalfii	21		
retusus	21		
rhitensis	21		
sp.	23		
Prairie Clover	39		
Psoralea	32		
micrantha	32		
tenuiflora	32		
Rattlebox	17		
Redbud	12		
Rhatany	15		
Rhynchosia texana	21		
Robinia neo-mexicana	24		
Screwbean	9		
Senna	13		
Sensitive Brier	10		
Smoke Tree	34		
Sophora	16		
arizonica	16		
sericea	16		
secundiflora	16		
stenophylla	16		
Spruce Clover	18		
Strombocarpa pubescens	9		
Sulla	39		
Sweet Pea	43		
Tephrosia	25		
leiocarpa	26		
tenella	25		
Thermopsis montana	17		
Tick Seed	40		
Tick Trefoil	40		
Trifolium	17		
brandegii	18		
fendleri	18		

